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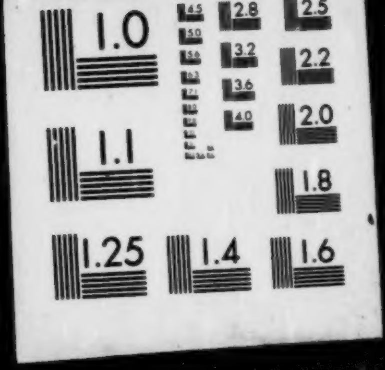

U.S. DEPARTMENT OF COMMERCE
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PROCEEDINGS OF WORKSHOP ON AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL HELD IN MAYFLOWER HOTEL, WASHINGTON, D. C. ON SEPTEMBER 16-17, 1974

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D. C.

PREPARED FOR
EXTENSION COMMITTEE ON ORGANIZATION AND POLICY,
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PROCEEDINGS

WORKSHOP ON
AGRICULTURAL NON-POINT SOURCE
WATER POLLUTION CONTROL

September 16 and 17, 1975 Washington, D.C.

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PROCEEDINGS

WORKSHOP
ON
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WATER POLLUTION
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SEPTEMBER 16-17, 1974 * MAYFLOWER HOTEL * WASHINGTON D. C.

FOREWORD

These proceedings are the product of a cooperative effort made by the Environmental Protection Agency and the Cooperative Extension Service to explore problems in agricultural nonpoint source water pollution control.

The symposium was convened on September 16 and 17, in Washington, D. C., and was attended by EPA Extension Service personnel from all regions of the country. This publication is the result of their work. It is hopefully the beginning of a close working relationship between the Federal and State environmental regulatory agencies and the State Extension Service as our country works toward the achievement of the clean water goals established by the Congress.

James L. Agee

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sistant Administrator for
er and Hazardous Materials

Charles P. Ellington

Charles P. Ellington
Director, Extension Committee
on Organization and Policy

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INTRODUCTION

Charles P. Ellington, Director
Cooperative Extension Service
University of Georgia

I am pleased to have the opportunity of meeting with you today in what I hope will be the first of many such workshops sponsored jointly between the Extension Committee on Organization and Policy and the Environmental Protection Agency.

Those of you who represent Cooperative Extension are already familiar with the Extension Committee on Organization and Policy (ECOP). For those of you who may not have previously had contact with ECOP, a few words of introduction are in order. The Extension Committee on Organization and Policy is a committee of the National Association of State Universities and Land Grant Colleges. It is a committee composed of the Directors of Cooperative Extension from each of the 50 States, Puerto Rico and the Virgin Islands.

ECOP has several standing subcommittees, one of which is the subcommittee on Environmental Quality. The subcommittee on Environmental Quality is a new one. It is only two years old. It was appointed for two main purposes.

One was to provide increased attention to Extension's efforts in Environmental Quality Education. And specifically to recommend to Extension Directors and ECOP, methods by which existing efforts may be strengthened.

Secondly, ECOP needed to establish a subcommittee to provide continuing liaison with the many Federal agencies involved in environmental efforts. Chief among these agencies is, of course, the Environmental Protection Agency. Others include the U. S. Department of Agriculture, HEW, Interior and the National Science Foundation.

You might well ask why is Cooperation Extension interested in Environmental Education.

There are several reasons:

First, Extension has been in the education business for the past 60 years. It has offices in virtually every county in the United States and has contacts with farmers, with processors, with marketing firms and with local leadership. It is hardly stretching the truth to say that someone in Extension knows every farmer in the United States by his first name.

Regulatory programs enjoy more success when the target audience fully understands all the requirements and also understands why they are necessary. Extension with its contacts can play a positive role in helping this country to clean up its environment.

Secondly, Extension already has specialists in many of the disciplines needed in an all out educational program of environmental improvement --- particularly in rural or nonmetropolitan areas. We already have -

Soil Chemists
Agricultural Engineers
Agronomists
Horticulturalists
Entomologists
Wildlife Specialists
Foresters
Food Scientists

And others who can contribute substantially toward environmental improvement. We also operate laboratories for soil testing, plant analysis, pesticide residues, feed analysis and others.

Third, we already have contacts and involvements with small and large operators in the grain and feed industry, the meat packing industry, the fertilizer industry, the pesticide industry, and poultry industry, and more recently with developers, with local planning agencies and with governing bodies at the State, County and Municipal levels.

Fourth, We have an information system which transmits factual information from the specialists to the county offices and eventually to the target audiences.

Fifth, because we feel that our contacts and our experiences put us in a position of possessing information which should be useful to any regulatory agency in assessing the impact of any proposed regulations.

Sixth, because it's our environment too and we are just as anxious to see it cleaned up as anyone else.

The real challenge that faces EPA and Cooperative Extension is broader than just regulating our existing practices in the production of food and fiber - for example, regulating feed lots, or cultural practices on farm lands. Most agricultural practices enjoy a fragile economic base. New regulations may upset production practices and ultimately may affect not only our supply of food but its cost.

No -- the real challenge that faces us -- Extension and EPA -- is to develop practices that will allow our farmers to continue producing low cost food while at the same time enhancing our environment.

So, I am especially glad to have this opportunity to represent ECOP in jointly sponsoring this workshop. And I look forward to the development of a lasting, mutually beneficial relationship between our two groups.

Joint Meeting of the Environmental Protection Agency and
The Extension Committee on Organization and Policy
September 15, 1974

Keynote Address to the Workshop on Agricultural
Nonpoint Source Water Pollution Control
by
James L. Agee, Assistant Administrator for
Water and Hazardous Materials

"The National Water Quality Strategy and the Role of Agriculture"

I. Introduction

The joining together in this Workshop of one of the oldest and one of the newest Federal agencies is a significant event. More than a century of time spans the passage of the Morrill Act by the Congress in the 1860's, the Smith Lever Act in the early 1900's and the creation of the Environmental Protection Agency and the passage of the Federal Water Pollution Control Act Amendments in the 1970's.

There is a common thrust in the missions of both agencies. With the Morrill and Smith Lever Acts, Congress established as the major purpose the development and transmission of the best possible technology of conservation management to the American farmer. In the Federal Water Pollution Control Act Amendments of 1972, the Congress mandated the application of the best practicable control technology and later the best available control technology for industrial wastes and the best practicable waste treatment technology for municipalities. Both are designed to restore the quality of the Nation's waters.

The acts are comparable in their delegations of responsibility. For all, the primary responsibility was placed on the State and both depend on active participation and management by States for successful attainment of stated goals. With these similarities of purpose within the Federal system, there is every reason to support a joint cooperative effort to attain the water quality goals established by the Congress.

The Federal/State Extension Service has set an example for all the world in the transmission of technology from researcher to farmer. To accomplish the reduction of pollution from our Nation's farms requires a major effort by all within the agricultural community, and I see you here today in a key role in the implementation of the necessary environmental technology.

II. The National Water Quality Strategy

Today we won't talk about pollution control, but rather about pollution prevention. We must stop pollution before it has damaged a resource, and if we are to be successful the Extension Service must play a key role.

On October 18, 1972, the "Water Pollution Control Act Amendments of 1972", (P.L. 92-500) were signed into law. This Act has been acclaimed as one of the most significant, and most comprehensive and most thoroughly debated pieces of environmental legislation ever to be considered by the

Congress. It is the culmination of a number of legislative efforts beginning in 1948.

Title I of P.L. 92-500 established the national policy for restoring the integrity of our Nation's waters. It established an interim 1983 goal, which is to achieve a quality in the Nation's water that will provide for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water. It established a national goal for the elimination of discharges of pollutants from point sources into navigable waters by 1985.

In order to achieve the 1985 goals, Federal, State and local governments must:

- cooperate in constructing necessary publicly owned waste treatment plants
- achieve the best practicable and best available control technology for industrial, municipal and agricultural point source discharges
- issue and enforce permits for point source discharges
- upgrade water quality standards to meet State goals
- develop areawide planning and management processes; pollution assessment; monitoring; and provide better approaches to the transmittal of technology and information necessary to reduce and eliminate all types of pollutional discharges to our navigable waters, including identification of nonpoint sources of pollution and development of guidelines for their control.

The Congress and the Administration have directed that we get into operation the best practicable control technology for point sources by 1977. This program is well underway. We have issued approximately 12,000 National Pollution Discharge Elimination System Permits, including 4,000 municipal permits serving 27 percent of the Nation's population. Permits that have involved the agricultural community have been issued for agricultural processing plants, animal feedlots, irrigation return flows and fish farms.

Effluent guidelines have been issued for meat product rendering and processing, dairy product processing, and grain mills and fruit, sugar mills, and vegetable processing. The permit writing and issuance process is well along.

For management reasons, the eligibility requirement for permit applications has been limited on the basis of facility size. In the case of irrigation return flows, the cut-off point was 3,000 acres of drainage. In the case of animal feedlots, the minimum size requiring application for a permit was 1,000 animal units.

You are probably aware that we are under pressure, including a suit filed by the Natural Resources Defense Council, to do away with the size cut-off points and issue permits for all point source regardless of size. If we move in this direction, either willingly or under court mandate, we will be involved with an enormous number of feedlot and irrigation permits.

Generally we have referred to the period from 1973 to 1977 as the Phase 1 implementation period and the years 1978 to 1983 as Phase 2. During Phase 1 we are emphasizing, as I indicated above, the issuance of permits and the awarding of construction grants. These actions provide the means for meeting many of the 1983 goals, and for some pollution sources achieving the 1977 requirements will be all that is necessary for 1983. Many of the pollution problems being addressed in this phase are well identified and are readily correctable, compared to many of the problems that will remain. Much of the Phase 1 is based on the solid achievements of the State and Federal governments in past years.

Phase 2 will be a period when solutions become more subtle and the alternatives for management and abatement more conflicting. It will demand a better understanding of the cause-effect and cost-effect relationships between objectives and results. This will be the period for implementing most of the plans for reducing pollution from nonpoint sources and for controlling the more difficult point sources of pollution. A solid start toward building the program foundations must begin now.

The State pollution control agencies have divided all basins into hydrological segments. Where the application of best practicable technology for industries and secondary treatment for municipal plants will result in meeting 1977 water quality standards, the segment will be categorized as an effluent guidelines limited segment. Where this technological base will be insufficient for the necessary level of water quality, the segment will be classified as a water quality limited segment. Initially, we must address our attention to the management of nonpoint source pollution from agricultural land in water quality segments and where it is cost-effective, in effluent limited segments.

III. Nonpoint Sources

About a third of the pollutants entering the Nation's waterways derive from what we presently describe and define as nonpoint sources. While Congress has legislated in the point source area for over twenty-five years, it was not until the 1972 Amendments that Congress addressed nonpoint sources. Thus, we are just beginning from the water quality point of view to seriously and programmatically address prevention of pollution from land runoff.

We in EPA recognize that the agricultural community has long been engaged in conserving the land and maintaining and increasing the productivity of the soil. We can list a great number of agricultural management practices of tillage, pest control, and fertilizing and harvesting, which can have substantial impact on improving or degrading water quality. It is my view that as we begin to articulate the strategy for the reduction of nonpoint source pollution with better management of our agricultural activities, that strategy must involve all of you in this room, as well as the entire agricultural community.

There is no question that nonpoint source control is regarded in our Act as a cooperative, intergovernmental responsibility with authority divided between EPA, other Federal agencies, several State agencies and local governmental units. The principal authority to the extent that it exists for regulatory activities is vested in the States.

We see two major initial thrusts of the general nonpoint source program.

* The first is to identify and/or develop State/local institutional authority to implement nonpoint source management practicies.

* The second thrust is to use currently available nonpoint source management practices to implement abatement programs on the well identified nonpoint source pollution problems.

The general program components include:

Assessment and Monitoring -

Planning and Management -

Information, Guidance and Policy Statements -

Pilot Control Programs -

Federal Agency Negotiations -

State and Local Development -

The first task that we have underway is a more definitive assessment of the contributions of nonpoint sources, including their identification and alternative measures for control. It is this task to which I see this Workshop addressing itself, particularly tomorrow afternoon in the Regional meetings.

The State basin plans and assessments of pollution sources will begin this year to provide information on nonpoint sources. We do not expect to have a complete picture by any means, but I am sure that we will have a good start and in some basins a very good estimation of the nonpoint source pollution loadings to the waterways. State extension specialists already have made substantial contributions in the development of runoff assessment and predictive techniques for sediment runoff.

EPA has published a series of technical informational reports for the control of specific types of nonpoint sources of pollution. We now have the task of refining such information into cost-effective guidelines that will articulate the best practicable control technology.

We in EPA need the continuing assistance from each and every one of you in the development and transmission of the technical guidelines and information that we will be issuing on nonpoint source pollution. We recognize fully the historic roles that the agricultural community and the U.S. Department of Agriculture have had in the development of technologies and information relating to agricultural wastes. We expect this continuing cooperation, but as in the past, the transmission and application of the technology are most important and often the most difficult links in the process.

One of the critical areas where many of you in the Extension Service have been working with us, the States and the community is in the water planning field. Integration of water quality basin and areawide planning with land use and management planning is essential. We must thoroughly recognize the long history of the agricultural community in land management planning. The work of the Soil Conservation Services together with the Extension Service has resulted in farm conservation plans and watershed plans. These plans serve as the basis of water quality management for the reduction of nonpoint contributions from the Nation's farms. Thus, the development of a process for the integration of the land planning activities of the agricultural community with State basin planning efforts, areawide planning and management and the State program control planning required in P.L. 92-500 is one of the important aspects that we can begin to address at this workshop.

IV. Conclusion

The opportunity before us, then, is to improve communication and build trust, first of all. Secondly, it is to assess the problems and probable solutions, which is the focus of your Regional workshop sessions; and thirdly, and most importantly, build a basis for continued communication and cooperative efforts. We in EPA know that without the full dedication of the Federal/State Extension Services, the management practices to control nonpoint source pollution from agriculture will not be implemented satisfactorily. We must move forward, together, with an understanding of common purpose and a determination to achieve our common objectives.

Agricultural Water Pollution Control
State and Local Teamwork

Grant Merritt - Director
Minnesota Pollution Control Agency

Based on our experiences in Minnesota, I think it is fair to say, that farmers individually are as interested in preventing degradation of our rural environment as anyone. A year and a half ago, we were confronted with the largest potential nonpoint source agricultural pollution problem of all, the Minnesota Experimental City. Planned and designed by engineers of the University of Minnesota's Institute of Technology, the project was to contain 250,000 people and was to be laid out in an agricultural area near Alexandria, Minnesota or up north near Grand Rapids. We were asked by State legislators to assess the environmental impact of such a project.

By working with farmers and local and county governments, we soon discovered that this philosophy of development, this huge development project, presumably to provide new experiments in urban settings, would rip off 50,000 acres of rural environment. We held meetings, environmental impact hearings, and by working with the farmers directly, we were able to beat the project. This is one of the best examples of how the State government can work directly with the farmers to avoid what I think would be the largest of all NPS problems.

The State and Federal experiences have primarily been concerned with point sources. I think this morning probably the best thing I can do is relate some of the experiences we have had in establishing the permit program for point sources, primarily for feedlots. From this framework of experience, we may be able to transfer our knowledge to solve the very difficult problem of NPS pollution.

I am sure you know, there are two basic types of animal confinement operations from which discharges can occur. One is the open out-door feedlot, the other, the closed-door confinement facility. In Minnesota, we have a large number of open feedlots varying anywhere from two to thousands of animals. Of course, the potential of pollution hazards from many of these operations is great because of the vast water resources we have in Minnesota. The potential pollution hazards from confined feedlots is somewhat less. Generally, these facilities have all the animals under one roof. We have noticed in Minnesota a trend toward the design of confinement buildings using slatted floors in pits underneath the building.

When constructed properly, this system is environmentally sound and is beneficial both to the farmers and the environment, as it provides an efficient method for collection and storage of animal wastes and an opportunity to spread those wastes back on the land and recycle them.

Many of our operations in Minnesota have had their animal lots built right next to the streams and on slopes near the lakes. Some of these lots were situated specifically so that the wastes could drain into the water. This has created a problem that we have been trying to correct in Minnesota for some five or six years, through information distribution programs using extension personnel, county government solid waste experts, local government people, and those from our regional offices.

Our experience has been that we are better off treating the runoff from these feedlots as a resource and emphasizing the recyclability, rather than attempting to treat the wastes to the point where it will meet water quality or effluent standards. We are now attempting to fuse our State permit program with NPDES (National Pollution Discharge Elimination System) permits. However, this has posed some difficulty, since the NPDES permit program basically implies a discharge and involves treating the wastes in order to meet a standard, and our work in the feedlot permitting program emphasizes recycling. I hope that in eventually joining these two programs together, and continuing to recycle the wastes, we can meet our responsibilities under the Federal law.

Generally, when it comes to nonpoint sources, I think we should focus on the control over growth and development along the waterways to prevent erosion and sedimentation pollution problems. Development will continue along these waterways unless we adopt some form of State zoning or land use control. Until then, we will not be able to successfully deal with the continuing development and associated sediment pollution of the rivers and lakes.

One of the most troublesome of all NPS problems is the whole area of pesticides, insecticides, and fertilizers. The trend is to rely more and more on pesticides and artificial fertilizers to get more yield with less land and less bother. I do not think that the consequences of this increasing use of chemicals are really fully understood. These new chemicals are creating far more serious pollution and environmental problems than their creator would ever admit. I know that Minnesota right now is having quite a furor over the use of 2-4-5-T, primarily by forestry managers. The environmental groups, some of the same ones suing EPA or other agencies, are developing more and more pressure to stop the use of that kind of pesticide.

While EPA has led the way in restricting the use of some of these chemicals, we are still very much concerned and the State Agency is looking at this problem. In many cases the legal framework for the control of certain chemicals has been developed. In talking about control of the use of fertilizers in farm areas, we have run into the same kind of buzz saw that we did five or six years ago when we began to discuss State control of the feedlots. This is an area that will need a great deal of careful education, information and cooperative work with Extension groups and local and county governments; and most important of all, by talking directly with the farmer about the problems. In order to have a successful program, we must bring home the problems of the environment directly to the farmer and ask for his cooperation in developing the program before it is underway. The farmers, to some extent, have been encouraged by the chemical companies to use more chemicals than are necessary. I think that in the future we need to have far more wisdom than we have exhibited in past to manage the farm use of these chemicals. Too often some "experts" have been quick to condemn environmentalists' concern about wide use of certain chemicals, without considering the possibility that these concerns may be valid.

At this point, I would like to go into greater detail in discussing the Minnesota experience with feedlot runoff. We have some one hundred and six thousand confined animal facilities in Minnesota. Translating that into human equivalents, it is about 20 million additional humans in Minnesota over and above 3.8 million population. Some 50,000 of those 106,000 confinement facilities need modification. In 1967, studies were made of causes of lake eutrophication in the rural areas of South Dakota. The results pointed to runoff from feedlots, as a major contributor to this eutrophication. These studies convinced us that we were going to have to develop some kind of permit program to prevent the feedlot runoff from causing a water quality problem! In Minnesota we have a wealth of water not only part of the greatest fresh water lake, Lake Superior, but some 15,000 or more lakes and a large number of rivers and streams and creeks. Additionally we have about a 25 inch average annual rainfall with 5 inch average runoff. Some 10% of our land is within shoreland. We had to make some very basic decisions, about how we were going to begin this program if we were going to be of any success whatsoever in controlling feedlot runoff.

The Governor appointed a nine member committee, including farmers to recommend regulations to our pollution control agency. The farmers, along with local and county officials, helped prepare the regulations. They proposed that we establish a permit program, hold hearings around the State and develop as much support as possible for controlling new feedlots. Existing feedlots which have either a pollution problem or potential pollution problem, would be grandfathered into the permit system, at least until there was a change in ownership or sale.

This program was begun in the late 60's; hearings were held around the State, numerous information and education programs were conducted involving Extension agents and SCS personnel and others. Finally, the permit program was adopted in April 1971. The first year we had less success than in the first year of the NPDES program at the National level. We soon discovered that the only way we were going to develop this program in any kind of numbers was to rely on county government. By dealing at the local level, we have issued some 3,000 permits. We are currently turning out 200-300 permits for feedlots or poultry lots per month. The further delegation of some of our programs to the counties will step up this 200-300 per month average by this time next year.

We have relied heavily on the SCS for the design of the feedlot control facilities. The substantial incentive to the farmers was the 75% reimbursement program for conservative practices. The State, also established the tax incentive of a 10% credit against tax.

I think the success of our program, and it has been successful over the last several years, is the teamwork we have been able to establish between State, local and county governments, working directly with the farmers. This kind of approach really is the only way to deal with nonpoint source problems. When we look at the future role of the States, I think the key will be information and education programs for county personnel and Statewide Extension personnel to work with the farmers and get them on our side. The farmers, I think, are more aware of the environment than city dwellers, and I suppose that is the basic hope that I see for the future as we grapple with nonpoint source pollution.

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1. Minnesota Statutes (M.S.) 115-116 (Including Supplemental Laws 1973)

2. Minnesota Regulations-Water

    A. Chapter WPC-15
    B. Chapter WPC-36

3. Minnesota Regulations-Solid Waste

    A. Regulation SW 51-55
    B. Regulation SW 56-61

4. PL 92-500

5. Federal Regulations

    A. Title 40, Part 412
    B. Title 40, Part 124
    C. Title 40, Part 125

6. Animal Wastes

    Minnesota Pollution Control Agency

    Division of Solid Waste

LAND MANAGEMENT AND WATER QUALITY

K.M. Mackenthun*

AN ENVIRONMENTAL GOAL

A quarter of a century ago this year, Aldo Leopold (1949) wrote, "Conservation is a state of harmony between men and land." Today, like all advancing nations, the United States is using land more extensively than ever before. Certain kinds of land resources are becoming scarce--land within a reasonable distance of urban centers available for housing, recreation, and waste disposal; land within cities that can be used for transportation networks, parks and open spaces; and land to accommodate commercial facilities, housing, and centers of higher education. We must conserve valuable farmland in order to provide food and fiber for our still-expanding population and world markets. Leopold lamented the fact that despite nearly a century of propaganda, conservation still proceeded at a snail's pace. He underscored the need for an environmental ethic. Yet today, the environmental goal must be to harmonize land-use practices with society's required uses of water. A land-use ethic is needed now more than in Leopold's time. Quality of life and environmental quality are synonyms for a living society.

AGRICULTURAL LAND MANAGEMENT CONCERNS

Principal concerns associated with agricultural practices are land management practices associated with crop production, animal feeding, fertilizer application, and pesticide application. The most serious polluting agents appear to be eroded soils, nutrients, and pesticides. Four billion tons of sediment are washed into the Nation's streams annually as a result of land misuse. Not all, but some, originate from land-management practices in crop production.

---

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Sediments from agricultural lands transport nutrients and pesticides generally as adsorbed materials. Ungrazed watersheds have been shown to produce about 70 percent as much runoff as grazed watersheds and sediment yields from ungrazed watersheds averaged 66 percent of those yields from grazed watersheds (Lusby, et al., 1971). Nutrient losses from farmland have been shown to be significantly greater than those from woodland areas and 5 percent of the pesticides applied to lands may enter waterways through surface runoff and erosion (Taylor, et al., 1971; Lin, 1972).

A cow generates as much manure as 16.4 humans, one hog produces as much waste as 1.9 people, and seven chickens provide a disposal problem equivalent to that created by one person. As a result, farm animals in the United States produce ten times as much waste as the human population (Hawkes, 1966). Obviously, much of this waste remains on the land to resupply the nutrients that are used in crop production. When it does reach a stream, water pollution of some consequence is produced.

The wintertime runoff concentrations from unpaved cattle feedlots have been shown to range from about 7 to 750 mg/l total phosphorus (P), whereas rainstorm runoff has ranged from about 4 to 46 mg/l P (Gilbertson et al., 1970). The ammonia nitrogen concentration in winter runoff exceeded a maximum of 2,000 mg/l, whereas during rainstorms, a maximum of about 80 mg/l was obtained. The areas of the feedlots tested were about 2,000 square feet each.

In the United States, the application of nitrogen in commercial fertilizers has risen from less than 400,000 tons in 1940 to about 7,000,000 tons in 1970 (Lin, 1972). In 1972 the Environmental Protection Agency issued a policy on control of nutrient runoff from agricultural lands. The essence of the policy was that the use of fertilizers should be adjusted to the nutrient availability and retention capability of various soil types of the appropriate agricultural areas. Animal wastes should not be applied to farmlands under adverse soil or weather conditions except when planned methods will ensure that they remain on the land. Storage of the wastes in designated structures until they can be incorporated into the soil should be used. Watering and feeding points for animals should be established away from waterways along with the establishment of runoff and erosion control measures to prevent the concentration of animal wastes in the vicinity of the streams.

Pesticides may enter surface waters as a result of drift from aerial applications, overland drainage, intentional dumping, discharge of wastewater from the cleaning of contaminated materials and equipment, incinerator and open-burning gaseous and particulate discharges, wind-blown treated materials, and accidental spills. The occurrence of pesticides in waterways is primarily due to their adsorption on small particles in runoff water. Once in the aquatic environment, pesticides may enter aquatic organisms either directly through ingestion or absorption of contaminated water or indirectly by feeding on previously contaminated organisms. Most pesticides are toxic at some level and may kill an aquatic organism outright. They may interfere with an important life process of an organism such as spawning or the development of the young, or they may accumulate within the aquatic food web later to poison some animal that uses fish or other aquatic life as a source of food.

Walker (1970) determined that in 1966 about 37 percent of the farmers growing crops used herbicides, 29 percent used insecticides, 4 percent used fungicides, and 8 percent used other pesticides such as growth-regulators, miticides, and rodenticides.

WATER POLLUTANTS FROM AGRICULTURAL LAND USE PRACTICES

There are several types of pollutants associated with agricultural land management concerns. These include the introduction of nitrates into groundwaters that later may be used for drinking purposes, the introduction of erosion sediments and fertilizing nutrients into waterways, pesticides, total dissolved solids, oxygen-demanding substances, and ammonia concentrations that may be toxic to aquatic life.

Increases of nitrate in groundwater caused either directly or indirectly by man's activities have been a special area of concern because of this chemical's suspected harm to children if concentrations in drinking water supplies exceed 10 mg/l nitrate nitrogen. According to Walker et al. (1972), many Illinois farm groundwater supplies reached or exceeded 20 times the level indicated as dangerous by Public Health Service drinking water standards. Nitrates in groundwater are a potentially serious problem in many areas of the country. The primary sources of excessive nitrate in most affected groundwater supplies have proven to be animal and human wastes and nitrogen fertilizers. Nitrate is readily dissolved in precipitation and is carried into surficial groundwater aquifers during the groundwater recharge period of late fall and early spring. Nitrate fertilizers pollute surface and subsurface waters where excessive amounts are applied and under high rates of rain and irrigation. Nitrate is water soluble. Beef cattle feedlots of over 70,000 head in one unit in Ohio raised the nitrate content of the soil 20 feet deep to a maximum of 5,000 pounds per acre (Harrold, 1969).

When erosion occurs, phosphorus levels in water may increase because fertilizers and certain pesticides tend to attach themselves to top soils which are lost first during erosion. Armstrong and Rohlich (1970) found that in many areas of the country agricultural land is an important contributor of nitrogen and phosphorus to water and to eutrophication. About 60 percent of the nitrogen and 42 percent of the phosphorus were estimated to come from agricultural lands where agriculture is practiced. Tile drainage systems contributed an average of 19.3 mg/l nitrate nitrogen and 0.09 mg/l phosphate phosphorus with an average discharge of 1.4 acre feet per acre per year in studies conducted in the San Joaquin Valley (California State Department of Natural Resources, 1971).

Concentrations of total dissolved solids in Colorado River Basin streams have been identified as a major problem for lower basin water users (Blackman et al., 1973). Irrigated agriculture was found to contribute about 37 percent of the upper Colorado River Basin salt load and about 9 percent of the lower basin salt load. The upper basin contributed about 72 percent of the lower basin's load. Salt yields from irrigated lands ranged from near 0 to 8.5 tons per year per acre.

Of the total water applied during an irrigation, as much as two-thirds may be used consumptively by direct evaporation from the land along with transpiration by plants. The plant uses the pure water fraction of root-zone moisture and the remainder is left with an elevated mineral and soluble nutrient concentration. Thus, evapotranspiration alone may concentrate the solids in the applied water by about 3 times. If application to the land is excessive, as frequently occurs, downward percolation through the soil will ordinarily leach additional mineral matter, increasing the concentration of salts as much as 3 to 10 times the original level in irrigation return flow.

Pollution of ground and surface waters can be insidious. The rate of degradation ordinarily is low and the amount of introduced pollutant commonly small compared to the volume of the receiving water body. The increase in water quality degradation easily can remain undetected until such time as physically noticeable effects (taste, damage to salt-sensitive crops, etc.) call attention to the existence of a serious problem.

Waste from feedlots and other agricultural areas contribute oxygen-demanding substances that deteriorate the quality of the receiving water, and during periods of intense runoff, sufficient ammonia has been introduced from combined animal feeding areas to create massive fishkills in receiving waters.

AN ECOLOGICAL PERSPECTIVE

Agricultural wastes encompass all of the major forms of water pollutants: some are organic and deprive the water of oxygen for its inhabitants; some wastes contain settleable organic solids that form sludge banks, destroy living areas for bottom-associated fish-food organisms, and deprive the superimposed water of oxygen through processes of decomposition; some wastes contain pesticides and other toxicants that kill fish or other organisms, are chronically toxic affecting reproductive potentials or other life stages, or bioaccumulate within the aquatic food web to affect adversely a consumer of aquatic life; many agricultural wastes contain nitrogen and phosphorus and other fertilizers that produce an abundant aquatic crop that may result in a severe nuisance or interfere with other uses of water; most agriculturally associated wastes contribute a sediment load to the receiving waterway that has many destructive aspects; and those agricultural wastes with high nitrate concentrations often pollute groundwaters to a level that has the potential to induce methemoglobinemia particularly in infants that may drink the water. These are the major ecological problems associated with agricultural wastes.

The ecological effects of such wastes on streams, lakes, groundwaters, and estuaries depend in large measure on the type of receiving waterway. To describe completely such effects is to develop a book with chapters devoted to the effects of organic wastes, of inert sediments, of toxic pollutants, and of nutrients as each may be manifested in streams, lakes, and estuaries. In the most general sense, silts or sediments will destroy the aquatic life that is associated with the bed of a receiving water. Such aquatic life is an essential component of the aquatic food web and its destruction results indirectly in the destruction or deterioration of fish and other organisms that may feed upon this type of life. The removal of oxygen, of course, affects adversely all forms of aquatic life associated with water. The introduction of pesticides or other toxic substances, likewise, affects all forms of life when the substance is present in toxic amounts. It may destroy directly and acutely; it may destroy over a long period of time through physiological alteration of the organism or reproductive impairment; or it may accumulate without immediate perceptible harm but with the latent potential to either affect adversely the organism in which the toxin has accumulated or that of the next consumer's level within the food chain. We are all familiar with the effects of nutrients introduced into lakes and the resulting problems of eutrophication, which have resulted in the expenditure of large sums of money to develop means of control and to pursue avenues of prevention. Estuaries are a particularly fragile ecosystem of the environment. They are the recipients of pollutants from all of the lands. They are the link between the land and the vast oceanic resource. They are the nursery areas for the ocean. Unfortunately, they become the transfer points between pollutants from the land and the aquatic food supply of nations.

Streams and rivers can cleanse themselves of pollutants quite rapidly when pollution is stopped. Estuaries cleanse themselves much less rapidly than streams because of the ebb and flow of the tides and the necessity for the materials to be flushed from the estuary. With the introduction of bioaccumulative materials, the process is slowed even more, because of the necessity to reduce the tissue content sometimes through a process of succeeding organism generations. Of particular concern are groundwater aquifers. These are the waters that a great number of people depend upon for drinking purposes. These are relatively unpolluted waters, but when pollution does occur, it persists for a great length of time.

DEVELOPING A LAND-USE ETHIC

Laws and regulations provide a framework and a focus for national concern. Quality criteria provide levels for particular constituents that are believed to be protective of environmental uses as a result of scientific experiments or investigations. Environmental standards provide a legal framework for implementing designated quality criteria and also provide a compliance schedule. These avenues of approach to control pollution exist and generally they are adequate and correspond to existing environmental knowledge and the technologic state-of-the-art.

These environmental pollution control tools do not necessarily provide the ultimate in environmental protection. In addition to a foundation of good laws, regulations, criteria and standards, we must develop a meaningful citizens' environmental concern and consciousness in all age groups. We must develop and practice a meaningful environmental ethic, both as individuals and as a community. We search still, even as Aldo Leopold a quarter of a century ago, for such an ethic. He wrote that, "An ethic, ecologically, is a limitation on freedom of action in the struggle for existence..." He stated that an environmental ethic must reflect the existence of an ecological conscience and a conviction of individual and community responsibilities for the capability of the water, land and air environments for self-renewal. Such an ethic must embody ethical and aesthetical qualities in addition to the essential economic and technologic considerations. The integrity, quality of life, stability, and beauty of the biotic community and the environment that supports it must be preserved. He wrote, "A decision is wrong when it tends not to foster these principles." Leopold knew of what he wrote. He was a renowned professor of wildlife management at the University of Wisconsin and he knew the land and the plants and animals that resided thereon.

Today, as never before, society is in need of an environmental ethic on the part of the residents on this planet Earth. The solution to environmental problems that confront us as a group is the heart of survival itself. The sages of yesterday were aware of this fact. Today's man on the street is convinced of its truth.

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"State of the Art in Identifying and Controlling Water Pollution from Agricultural Activities - Research Implications"

by

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State of the Art in Identifying and Controlling Water Pollution from Agricultural Activities - Research Implications

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References:

1. "Environment Protecting Concepts of Beef Cattle Feedlot Wastes Management," EPA, July 1973.
2. "Managing Irrigated Agriculture to Improve Water Quality," EPA, May 1972.
3. "Pesticide Transport and Runoff Model for Agricultural Lands," EPA, December 1973.

Compared to the length of time that research on pollution control from agriculture has been carried out by the U.S. Department of Agriculture, the Environmental Protection Agency is a relative new comer. Health and environmental effects of pesticides were perhaps the first of the problems related to agriculture to be investigated by the predecessor agencies to what is now the EPA. A comprehensive agricultural pollution control research program was initiated in March 1968 and has been an important component of the Office of Research and Development ever since. Agriculture studies are currently conducted within the Nonpoint Pollution Control Division, where other topics include programs dealing with pollution from mining, oil and hazardous material spills, and construction activities.

Early studies on agricultural pollution conducted under our research contract and grant mechanism were oriented toward the treatment of wastes, as in our animal waste activities. The lack of total success in achieving a satisfactory level of treatment, coupled with the urgent need to develop means for water pollution abatement at low cost and within a short period of time, has led us to emphasize more conventional, remedial measures. Rather than treatment alone, we are trying to promote control at the source of pollution by conservation-management practices.

Recent developments in the requirements for water pollution control have had additional impacts on the direction of research on agricultural pollution. With passage of the Water Pollution Control Act Amendments of 1972, nonpoint sources of pollution were brought under constraints similar to point sources. Certain agricultural operations come under the scrutiny of the Permit Program and have to meet rigorous effluent criteria. Just as the law requires that point source discharges implement "best practicable treatment" (BPT) by 1977, nonpoint sources have their own BPT - "best preventative techniques." This concept raises a number of questions, not the least of which is, "How and on what basis is this best preventative technique selected?" It has therefore been imperative that some means be developed to evaluate the efficacy of the various available remedial and conservation measures and to predict the effects on the environment of changes in commonly employed practices or the adoption of advanced management methods.

Our present emphasis, to meet the very real needs of the farming community is therefore to develop the means for assessing the magnitude of the nonpoint pollution control problem both nationwide and down to small watersheds and individual farm units, and to have available an array of demonstrated techniques and management tools to institute under a wide range of climatic, agricultural, and environmental constraints. These comments will serve as background for a description of the three major components of our agricultural pollution control research and development activities - animal wastes, irrigation return flows, and agricultural chemical runoff.

The major goal of the animal feedlot wastes R&D program is to define the animal waste problem, conduct and stimulate research, development and demonstration of practical and economically acceptable animal wastes pollution control technology and to make the results available in user-oriented manuals of practice. The program is designed to meet immediate as well as long range needs for the application and evaluation of pollution control techniques, equipment, and recycle and reuse systems.

Studies are done under grants and contracts with universities, private individuals, and by interagency agreements. At the present time we have an Interagency Agreement with the USDA-ARS at Fort Collins, Colorado, and Lincoln, Nebraska, on a project entitled "Pollution Abatement from Cattle Feedlots in Northeastern Colorado and Eastern Nebraska." The total cost of this study is estimated at $1.2 million of which EPA is funding half. The project will determine the extent and kinds of microbial, chemical and organic pollutants entering the atmosphere, soils, and surface and underground water supplies and evaluate different feedlot management systems for their effectiveness and efficiency in disposing of both liquid and solid wastes from cattle feedlots in two contrasting climatic zones -- northeastern Colorado with annual precipitation of 14-15 inches and eastern Nebraska with annual precipitation of 27-28 inches.

Other projects at various locations around the country are evaluating systems for handling animal wastes, such as anaerobic-aerobic oxidation ponds, recirculating swine waste treatment systems, land disposal methods, and recycling and resource recovery. One of these projects involves determining the status of research on effects of land disposal from animal waste disposal on land, to assemble recommended loading rates of animal waste on land and to identify present knowledge gaps and suggest areas of research needed on the effects of this practice. In the meantime, however, other related work includes: evaluation of plant-soil filters; determination of the maximum environmentally safe application rates for disposal of wastes on the land compatible with maintaining reasonable rates of crop production; the concentration and movement of chemical and bacteriological waste components by surface runoff or leaching through the soil; the utilization of liquid animal wastes by crops through overland spray; and, techniques for and effectiveness of subsurface injection of animal wastes are being studied. The culmination of all of these efforts will be a manual of use incorporating suggestions on how to determine where, when, how, and how much manure should be applied to the land. We expect to have final land disposal assessment and criteria manuals listing BPT equivalent completed by June 1977.

One such user-oriented manual has already resulted from the studies on animal waste problems. In July 1973, a manual entitled "Environment Protecting Concepts of Beef Cattle Feedlot Wastes Management" was published. The manual will serve as a guide to insure consideration and incorporation of pertinent environmental pollution controls in the design and operation of beef cattle feedlots, and to serve as a reference source for the more detailed information contained in published literature on feedlot design and operation. The concepts presented in the manual are applicable to feedlots other than cattle. Topics covered include discussions of the currently available viable options for confinement facilities with details relating to wastes management, the factors which should be considered in choosing a location for a new feedlot or in modifying an existing lot to avoid pollution-related problems, the system components available for handling solid manure, slurries, and liquid runoff, economic comparisons of alternative systems, and suggestions for coexistence of the feeding industry with society.

Our research on irrigation return flows has a similar practical goal. The objective of this R&D program is to develop practical and economically acceptable means to control the pollutant contributions (i.e., salinity, nutrients, sediments, pesticides) from irrigated agriculture to our surface and groundwater resources. Specifically the program is developing knowledge relative to prediction techniques, control measures and management systems that may be applied to water quality problems of irrigation return flows are by demonstrating that improved farm water management offers feasible means of minimizing salt and nutrient degradation of return flow without sacrificing crop yields. The ultimate output from these activities will be the development of recommendations and guidelines on irrigation practices, methods, and systems which would have the greatest effect of reducing pollutant contributions. We plan to have the manual available early in 1977.

Two Interagency Agreements are presently being supported by EPA and the Agricultural Research Service on irrigation return flow topics. The first, designed to minimize salt in return flow by improving irrigation efficiency, is being conducted by the U.S. Salinity Laboratory of Riverside, California, at the Wellton-Mohawk Irrigation and Drainage District in Arizona. The second joint project is being conducted with the Snake River Conservation Reserach Center in Kimberly, Idaho, to evaluate scientific irrigation scheduling for salinity control in irrigation return flows.

Additional studies are developing techniques for drip, trickle, and subsurface irrigation, are evaluating present water laws and the constraints which they place upon agricultural water management reform, are demonstrating practical salinity control technology (including cost-effectiveness) in water delivery and drainage subsystems, and are developing a mineral quality prediction model which typifies a combination of soil, climate, geologic, and hydrologic conditions found in broad areas of irrigated lands throughout the Western states. Mathematical models will have utility in preassessing the need for improved irrigation management and/or structural modifications as well as predicting the quality and effects of irrigation return flows. We hope to have this model and appropriate user manuals available by June 1975.

To date, the irrigation return flow research program has produced a number of major accomplishments, including: a state-of-the-art study which evaluated the characteristics and pollution problems or irrigation return flows; a national conference on "Managing Irrigated Agriculture to Improve Water Quality;" the evaluation of canal linings for salinity control in Grand Valley, Colorado; the publication of literature abstracts on irrigation return flow topics for 1968 through 1973; and the completion of feasibility studies on desalination and nitrate removal by algae growth and harvesting and by anaerobic denitrification which was conducted in conjunction with the Bureau of Reclamation and the California Department of Water Resources.

The third major area of EPA research on agricultural pollution problems is runoff of agricultural chemicals, including pesticides and nutrients. In this area our efforts are directed at defining the factors and establishing the relationships that influence the extent of chemical runoff from agricultural land with a view toward managing them to minimize pollution. If the effects and interactions of chemical type and formulation, soil properties, climatic conditions, watershed characteristics, and agricultural practices are clearly known, then usage guidelines can be developed that will aid in reducing runoff and subsequent pollution. It is expected that a mathematical model which is being developed will have watershed and gross basin-wide predictive and simulative capability and nation-wide applicability for all major pesticides and for the plant nutrients nitrogen and phosphorus.

Specifically, the agricultural chemical runoff model will have several uses: it will predict quantitatively the amount of chemical that will be contributed to a water body in runoff and conversely, will permit evaluation of benefits expected from the use of alternative corrective management/engineering practices; it will provide a basis for making pesticide and fertilizer usage recommendations, i.e., specify types, formulations, and application levels of a chemical for a given set of cultural, management, climatic, and soil conditions that will assure maintenance of acceptable water quality; and it can be useful for pesticide manufacturers in tailoring pesticide formulations to meet regional requirements for pollution prevention, and open the door for labeling and licensing pesticides on the basis of regional usage acceptability.

Work on the development of this model is being done in part under an Interagency Agreement with the Southern Piedmont Conservation Research Center of the ARS. Field data were collected during agricultural growing seasons from instrumented plots. Development of certain submodels and the gathering of data on some chemical/plant/soil/water relationships has been conducted under various research grants in different agricultural regions. Processes occurring during a rainfall event and accounted for by the model are downward chemical movement and net chemical transfer from the soil surface into the runoff film, both in solution and adsorbed on eroded soil. Processes affecting chemical concentration and phase redistribution between rainfall events include evapotranspiration, adsorption-desorption, net movement under conditions of unsaturated flow, and the attenuation processes of chemical, microbial, and photochemical degradation, volatilization and organism uptake.

The model itself has been developed and is available for verification. Although developed initially to evaluate pesticide losses, studies are underway to expand the model to account for plant nutrients. The model has been calibrated and tested for the Piedmont Region -- ultimately the Great Lakes, Corn Belt, and Coastal Plains will be included. As now developed, the pesticide transport and runoff model is composed of submodels concerned with hydrology, sediment loss, pesticide-soil interaction, and pesticide attenuation functions. The model piggybacks the applied pesticide onto the movement of water through the soil profile and the loss of water and sediment from the land surface. Ongoing work includes further calibration and testing of the model and additional refinement of the pesticide adsorption/desorption and attenuation functions.

One of the major questions still to be answered deals with a determination of the extent and location of nonpoint pollution and an evaluation of the degree to which the pollution can be abated by changes in land use management practices. In this regard, work is progressing on a project to provide a Nationwide assessment of water pollution from nonpoint sources. The project is to provide a National, regional, and basin assessment of the comparative nature, extent, distribution and variability of nonpoint water pollution sources in terms of their discharge of pollutants into surface waters. In addition, loading functions are to be developed using existing data and evaluated for use in determining the pollutant discharge load from individual nonpoint sources and from groups of sources found in typical land use patterns. These loading functions are to be validated using existing water quality and land use data and are to be integrated into a general handbook that can be used for subsequent nonpoint assessments on a watershed basis. This project will also serve as an information base for subsequent assessment and comparison of the controllability of nonpoint sources, including cost/benefit evaluations for management systems. Major nonpoint activities and sources under consideration in this project are agricultural activities such as crop production, livestock production including confined feedlot operations, and natural erosion from agricultural lands; silvicultural activities such as harvesting, log transport, and regeneration and protection; mining activities including extraction, preparation, and oil and gas production; and construction activities such as development of utilities and public facilities, residential and commercial property, and recreational areas.

In conclusion, I would like to point out that while much work has been done in developing technology and management methods to specifically address certain waste handling, chemical usage, or soil and water conservation problems, there remains the need to pull these scattered tools together into specific recommendations geared to environmental protection. Clearly there are gaps in the recommended management systems that can be made at the present time and studies must be continued to fill in these pieces. Studies must also be made to optimize cost/effectiveness and to advance alternative techniques to the demonstration stage to show to the land users the workability and advantages of various pollution control options. This cannot be solely an EPA effort. Cooperative programs with USDA and the farming industry are a necessity. Improved communication with the farmers through Extension Service programs and the farm press will assume increasing importance. At this point in time the future requirements are uncertain but the trend toward management of nonpoint sources of pollution is clear. Present studies designed to identify and control water pollution from agricultural activities will have a significant influence on the decisions to be made to bring about effective management of the environment.

Controlling Nonpoint Source Pollution From Agricultural Activities.

Robert E. Thronson

We can afford the price of a clean environment.

There are those thay say we connot afford to care. Knowingly or unknowingly, they would destroy both the environment and industry itself. They are unaware that it costs more to ignore the needs of the environment than to protect it. The simple fact is that caring for our land, air, and water is part of the act of doing business.

We do not object to paying for the cost of safety in our electrical appliances, buildings, highways, and automobiles. Why should we object to the long-range safety of our water, air, and land? According to the Wildlife Federation, the cost of cleaning up our environment will entail an investment of $500 by the average family by the year 1975. This investment would be recovered in increased savings by 1979, and from 1980 on each family would make a profit of $200 per year.

The impact of man's agricultural activities on the nation's water resources is extremely significant. Modern agricultural practices are becoming increasingly complex, particularly in their use of fertilizers, pesticides, irrigation systems, and confined animal feeding facilities. As a result, the potential for surface and ground water pollution resulting from these activities is greatly increasing. Preventing this pollution must become a major concern for these involved in the field of agriculture.

Identification of Pollutants

Pollutants resulting from agricultural nonpoint sources include sediment, dissolved salts, plant nutrients, pesticides, organic materials, and pathogens. Sediment which results from erosion of soils is considered to be the principal pollutant.

Mode of Transport

A knowledge of the mechanisms through which nonpoint source pollutants are transported to water bodies is essential in order to determine the nature and extent of pollution and measures for prevention or control. Much basic information is available regarding these mechanisms; however, the knowledge is not yet adequate to accurately predict losses from individual pollutant sources.

There are essentially 3 modes of transport of nonpoint pollutants from agricultural sources. They may be carried to receiving water bodies by surface runoff, ground water movement, or wind. In water, they may be transported in a "piggy backed" fashion adsorbed to fine-grained sediments such as salts and clays. Phosphates and pesticides often are tightly bound to sediments in this manner.

Philosophy of Control

EPA's early program emphasis will be placed on the implementation of control programs using presently available control technology. Control information will be published and widely distributed. Pilot control projects will be established in critical areas. These will be used to demonstrate the use of technical means of control, control program institutional arrangements, and the intergrated use of Federal-State-Local activities in control programs.

Research and evaluation of institutional arrangements will be conducted. General national policies guidelines will be developed. These will be adapted into standards and guidelines, to fit Regional, State and local areas. Because of the very diffuse nature of nonpoint sources, most of the control will be accomplished by obtaining on-site installation of control measures.

Control Measures

The following discussion provides some information concerning non-point pollution control "best preventative techniques" as we see them.

Erosion and Sediment

There are three natural processes involved in the movement of sediment from a farm site to a receiving body of water. They are erosion, transportation, and deposition. Control measures necessary to prevent sediments from the site and causing water pollution will involve decreasing the first two processes, erosion and transportation, and increasing the last one, deposition.

As you all know, agricultural conservation practices have been developed which also serve, at least partially, for these purposes. They range from management of surface cover and tillage to mechanical measures, or a combination of these.

Conservation tillage systems may be used in combination with other erosion control measures or may be the only measures used. They often provide for protection of surface soils with crop residues or develop a surface configuration that will increase water storage and infiltration and so reduce runoff. Other means of erosion control involve strip cropping, tilling on the contour, and the construction of terraces, diversions, or grassed waterways and other structures to control the energy of runoff water. Additional measures involve the use of cover crops, crop rotation, and other means of maintaining protective cover on soils. They are limited only by the initiative of the landowner and his desire to maintain the productivity of his soil resource.

Mineral Salts

The control of salinity and other pollution caused by irrigation return flow cannot be easily achieved. Control methods include the application of current technology and the development of new technology. Current technology includes methods of increasing the efficiency of the water development system, on-the-farm water management, and elimination of surface discharges of irrigation waters. These, combined with the application of irrigation scheduling and increased water-use efficiency will minimize pollution caused by irrigation returns.

Pesticides

There are several methods used to reduce the amount of pesticides moving into the aquatic environment. They are to (1) control erosion and transport of sediments, (2) prevent application when wind drift can carry pesticide into a water body, (3) apply optimum quantities necessary to control target pests or substitute non-chemical methods of pest control, (4) substitute biodegradable pesticides to the maximum extent possible, and (5) ensure proper use and disposal of containers and unused materials.

One involved in farming practices should consider alternatives before making the decision to use pesticides. They include practices involving changes in methods of cultivating and harvesting crops to make the site less hospitable to pests; using the pest's natural enemies for control; insect sterilization, toxins, or pathogens; resistant crop variations; insect attractors; and crop rotations.

Plant Nutrients

Most of phosphorous lost from land is associated with sediment. Organic or humus nitrogen lost is also adsorbed on sediments. Most nitrogen, however, is lost in the form of nitrate which is completely soluble in water and moves with it.

Reducing nutrient losses from agricultural nonpoint sources may be done by applying optimum amounts of nutrients at the proper time and place, adopting improved cultural practices such as conservation tillage and crop rotations that minimize nutrient losses, and controlling soil and water losses.

Animal Wastes

The nutrient content of animal wastes is highly variable. The most common, ecologically accepted, and lowest cost method of disposal is by application to the land.

When sufficient cropland is not available, large quantities of manure may be applied to the land with the emphasis on disposal rather than plant utilization. This may alleviate disposal problems but may create other problems such as accumulation of nitrate, salts, and other compounds.

Wastes may be solid or a slurry. Solids can be applied on the surface followed by no incorporation into the soil, immediate incorporation, or incorporation at a later date prior to crop planting. Slurry wastes are also commonly applied to the surface of the land although some injection systems are used.

Storm water runoff from combined animal feeding facilities is a source of pollution. Rentention ponds generally are used to trap and store this water which is removed and applied to the land as soon as possible after the runoff event to provide for additional storage.

EPA's Nonpoint Source Implementation Activities

The Office of Water and Hazardous Materials is presently involved with several activities which will provide information on nonpoint pollution control to Federal, State, and local agencies and lead to implementation of control programs.

State Sediment Control Institutes

In May of 1972, EPA awarded a contract to the National Association of Conservation Districts in Washington, D.C. for the conduct of a series of State sediment control institutes. The objectives of these institutes are to help bring about awareness of the increasing national concern regarding erosion and sediment control, provide knowledge of existing and proposed actions in this area by Federal and State organizations, initiate consideration of the physical and organizational aspects of control, and promote development of a plan of action for effective control of erosion and sediment runoff by responsible leaders of the State.

The Environmental Protection Agency uses these Institutes as a medium of explaining federal legislation relating to erosion and sediment control, the agency's administrative organization, and its responsibilities in this area of water quality control. Results of these Institutes are expected to facilitate and seek the enactment and adequate enforcement of state sediment control programs and legislation that will meet state and federal standards. At the present time about 35 of these institutes have been conducted. Ten States have enacted sediment control laws, fifteen others have drafted legislation, and twelve of these have introduced these laws before their legislative bodies for action.

Acceptance of the need for more rapid action in the field of erosion and sediment control by the States is growing; and new laws are being initiated. A "spinoff" from this State program appears to be the development of county and/or local ordinances which many times are stricter than State measures.

Forest Practices

There are many small form woodlot owners, particularly in the southeastern States, which periodically conduct silvicultural activities. These activities include pest control, fertilization, prescribed burning, timber harvesting, and the like. All are recognized as potential causes of nonpoint source pollution. To facilitate control in these areas and where large forest landowners predominate, we have just initiated development of a Model State Forest Practices Act to provide guidance to the States and to others in their nonpoint source control implementation efforts. Accompanying this, another document is being prepared which will delineate our Agency's policy on control of pollution from silvicultural activities. It will provide guidance to our Regions, and other organizations, in their control activities.

Pilot Control Programs

Soon after passage of P.L. 92-500, the Water Pollution Control Act Amendments of 1972, it became apparent that effective control of nonpoint source pollution requires the coordinated efforts of Federal, State, and local agencies in cooperation with the private sector. There is the need to combine technical, institutional, and legal aspects into a coordinated control program surfaced.

It was determined that pilot control programs conducted by our Regional Offices offered the opportunity to delineate and test the control programs and to actually obtain effective control in a limited area. Source category assignments have been made to our ten Regions on the basis of the national need, magnitude of the problem in the Region, and availability of background information. Four source categories were assigned for implementation in FY 74 with the remaining six to be implemented during FY 75.

Pilot control projects which involve agricultural activities, or are closely related have been assigned as follows:

FY 75

Region VII (Denver) - Irrigation Return Flows

Region X (Seattle) - Silviculture

Region V (Chicago) - Agriculture (Lake Eutrophication Aspects)

Region VII (Kansas City) - Agriculture (Monoculture Aspects)

Schedules for the pilot control programs vary with the thrust and complexity of each effort. A general pattern of schedule has been established, however, which resolves into the following three phases: (1) project planning, (2) project implementation, and (3) EPA withdrawal of active participation.

The principal purpose of the pilot control projects is the initiation, implementation, and evaluation of a coordinated control program. After this is accomplished, EPA's active participation in the particular project will be diminished. This does not mean that the project will not be continued, but that it will be continued by other Federal agencies, State, and/or local agencies.

Conclusion

There is a definite need to make people and organizations aware of how nonpoint source pollution resulting from agricultural activities can affect conditions around them and to provide information on processes procedures, and methods available for controlling this type of pollution at the source areas themselves.

Technical and professional people involved with these activities should become bold enough to express themselves against what they know to be pollution causing activities through their technical societies regardless of the views of their associates and others. Technical people often hide behind the "security blanket" of professionalism by limiting their discussion groups to other professionals only when they would do better by exposing themselves to public opinion and their critics. Environmental concerns are not a passing fancy but are here to stay and many professional people are flunking the course by following and not leading in the control efforts.

Effective control requires vigorous and aggressive action by all levels of government with the complete cooperation and support of concerned members of the community. We all know that the technical capability of control is largely available. The development and adoption of measures for effective control and the preparation of organizational procedures for applying the technical knowledge required is urgently needed. Cooperation between governmental groups concerned with control and others which provide the technical "know how" is essential to obtain a meaningful program. State and local organizations and their officials must acknowledge their share of the responsibility for control which often is diffused among several agencies. These agencies effectiveness many times is inadequate because they react to damage rather than undertaking action to prevent the environmental pollution.

EPA will not seek to dictate particular nonpoint source control practices, when the prescription of such practices may best be left to State and local authorities. Federal governmental groups can provide broad guidelines and some financial assistance for local areas but the principal tasks of developing proper management techniques, establishing adequate implementation procedures, and requiring effective enforcement methods must fall upon State and local officials. The impetus to adopt State legislation and local requirements for effective control must be provided by concerned and informed members of the State and the community involved.

PESTICIDES AS A NON-POINT SOURCE OF WATER POLLUTION

GOOD AFTERNOON. I AM VERY PLEASED TO BE PARTICIPATING WITH YOU TODAY IN THIS FINE WORKSHOP DEVOTED TO THE EXPLORATION OF THE NON-POINT SOURCES OF AGRICULTURAL WATER POLLUTION. THIS HAS BEEN AND REMAINS ONE OF THE MOST COMPLEX AREAS OF ENVIRONMENTAL CONTAMINATION, IN TERMS OF BOTH DETERMINING PESTICIDE EFFECTS ON A CAUSAL BASIS, AND DETERMINING SOLUTIONS, BOTH TECHNICAL AND REGULATORY, TO THE PROBLEMS. CERTAINLY, ENVIRONMENTAL CONTAMINATION IS ONE OF THE MOST VITAL CONCERNS OF THE OFFICE OF PESTICIDE PROGRAMS, AND I WOULD LIKE TO SHARE WITH YOU TODAY OUR THINKING ON THE SOURCES OF PESTICIDE ENTRY INTO WATERWAYS, THE STEPS WE ARE TAKING TO MONITOR THE IMPACT OF THOSE SOURCES, AND SOME OF THE MEANS AFFORDED US BY LAW TO ELIMINATE OR MINIMIZE THOSE SOURCES. ALSO, I'LL MENTION SOME ASPECTS OF THE ROLE THE EXTENSION SERVICE CAN PLAY IN THIS AREA.

TODAY, PESTICIDES ARE, OF COURSE, CRUCIAL TO THE ADEQUATE PRODUCTION OF FOOD AND FIBER IN THIS COUNTRY. WHILE ADVANCES IN INTEGRATED PEST MANAGEMENT MAY CHANGE THIS RELATION, IT MAY NOT BE EXPECTED TO HAPPEN IN THE

Address by Edwin L. Johnson, Associate Deputy Assistant Administrator for Pesticide Programs, before the Workshop on Agricultural Non-Point Source Water Pollution Control, Mayflower Hotel, Washington, D. C., September 16, 1974.

SHORT-TERM. AGRICULTURAL USES OF CHEMICAL PEST CONTROL AGENTS HAVE INCREASED OVER THE YEARS AS THE POPULATION HAS GROWN WITH ITS ACCOMPANYING NEED TO CONCURRENTLY EXPAND CROP YIELD. CERTAINLY, THE PEST CONTROL ARSENAL AFFORDED BY MODERN TECHNOLOGY HAS CONTRIBUTED UNQUESTIONED BENEFITS TO SOCIETY. HOWEVER, AS YOU ARE ALL AWARE, THE DETRIMENTAL EFFECTS OF PESTICIDES -- THEIR IMMEDIATE TOXICITY, THEIR PERSISTENCE, THEIR MOBILITY, THEIR ACCUMULATION IN THE FOOD CHAIN -- CONTINUE TO CAUSE ALARM, BOTH IN THE SCIENTIFIC COMMUNITY AND IN THE PUBLIC AT LARGE. ONE OF THE FACTS OF PARTICULAR CONCERN TO THE PUBLIC IS THE PRESENCE OF PESTICIDE RESIDUES IN WATER. AS WE IN THE OFFICE OF PESTICIDE PROGRAMS ARE REMINDED DAILY, THE PUBLIC IS AWARE, AND QUITE VOCALLY SO, OF THE ENTRANCE OF PESTICIDES INTO OUR VALUABLE WATER RESOURCES, AND IT WANTS, IT DEMANDS, THAT THE GOVERNMENT TAKE AN ACTIVE PART IN REDUCING SUCH CONTAMINATION.

ONE OF THE MORE INTRIGUING ASPECTS OF PESTICIDES, AND CERTAIN OF THE OTHER POTENTIAL CONTAMINANTS OF WATER, SUCH AS FERTILIZERS, WHICH YOU WILL BE DISCUSSING IN THESE WORKSHOP SESSIONS, IS THAT THE MATERIAL MUST INTENTIONALLY BE RELEASED INTO THE

ENVIRONMENT IF IT IS TO ACHIEVE ITS BENEFICIAL EFFECTS. ONCE SO RELEASED, ITS LATER MOVEMENT AND EFFECTS ON THE ENVIRONMENT ARE EXTREMELY DIFFICULT TO CONTROL. THIS IS A CONSIDERABLY DIFFERENT CIRCUMSTANCE FROM MOST POLLUTION SITUATIONS IN WHICH CONTAMINANTS ARE RELEASED INTO THE ENVIRONMENT BECAUSE THEY HAVE NO RESIDUAL ECONOMIC VALUE AND ARE MERELY BEING THROWN AWAY IN THE CHEAPEST POSSIBLE MANNER.

IN THE CASE OF PESTICIDES, OF COURSE, ASIDE FROM MANUFACTURING DISPOSAL AND EXCESS PESTICIDE DUMPING, IT COSTS MONEY AND PRODUCES BENEFITS TO INTENTIONALLY PLACE THESE SUBSTANCES IN THE ENVIRONMENT. THEY ARE OF NO AGRICULTURAL VALUE UNTIL THEY ARE SO UTILIZED. THIS CIRCUMSTANCE MAKES UNIQUELY IMPORTANT THE ROLE OF THE EXTENSION SERVICE AS FARM PRACTICE LEADERS AND EDUCATORS IN REDUCING THE AMOUNT OF WATER CONTAMINATON FROM PESTICIDES. AS WE CONSIDER VARIOUS SOURCES OF PESTICIDES IN WATER, IT IS EVIDENT THAT REDUCTION IN THE AMOUNT OF THESE CHEMICALS REACHING WATER MAY BE ACCOMPLISHED THROUGH AT LEAST TWO MECHANISMS:

FIRST, BY REDUCED USE OF PESTICIDES IN GENERAL, OR OF PESTICIDES ESPECIALLY ASSOCIATED WITH ENTRY INTO WATER. THIS TASK MUST BE ACCOMPLISHED WITH FULL

COGNIZANCE AND REGARD FOR COST/YIELD RELATIONS AND THEIR IMPACT ON THE FARMER'S ECONOMIC POSITION, TAKING INTO ACCOUNT NEW TECHNOLOGY OF PEST CONTROL, PARTICULARLY THE RAPIDLY DEVELOPING TECHNOLOGIES OF INTEGRATED PEST MANAGEMENT.

SECOND, THROUGH APPLICATION OF OTHER AGRICULTURALLY DESIRABLE PRACTICES, SUCH AS THOSE RELATED TO WATER CONSERVATION AND SOIL EROSION PREVENTION.

PROPER USE DIRECTIONS AND ENFORCEMENT TO ASSURE USE CONSISTENT WITH SUCH DIRECTIONS ARE OF COURSE MAJOR ELEMENTS OF EPA'S PESTICIDES REGULATORY PROGRAM. HOWEVER, BEFORE THE FACT COMPLIANCE IS AT LEAST AS IF NOT MORE IMPORTANT THAN AFTER THE FACT ENFORCEMENT, AND WE IN PESTICIDES ANTICIPATE THE EXTENSION SERVICE PLAYING A SIGNIFICANT ROLE IN EDUCATING THE FARMER TO THE PROPER UTILIZATION OF PESTICIDES, AND TO THE ADOPTION OF LESS PESTICIDE INTENSIVE METHODS OF PEST CONTROL. THE EXTENSIVE AND UNIQUE TECHNOLOGY TRANSFER CAPABILITY, THE SCOUTING PROGRAMS, AND THE DAY-TO-DAY PROGRAM WITH GROWERS CONDUCTED BY THE EXTENSION SERVICE PROVIDES A VEHICLE FOR MUTUALLY FURTHERING THE CAUSES OF AGRICULTURE AND THE ENVIRONMENT TO THE BENEFIT OF

SOCIETY AS A WHOLE.

OBVIOUSLY, THE PHYSICAL AND CHEMICAL PROPERTIES OF ANY PESTICIDE GOVERN ITS MOVEMENT FROM ONE ECOLOGICAL SYSTEM TO ANOTHER. WHILE WE CERTAINLY DO NOT KNOW ALL THE ANSWERS ABOUT THE MOVEMENT OF THESE CHEMICALS, WE DO KNOW THAT THE PROCESSES WHICH REGULATE THE RATE OF MOBILITY OF PESTICIDES FROM SOIL TO WATER ARE INFLUENCED BY THE CLAY AND ORGANIC CONTENT OF THE SOIL, THE SOLUBILITY OF THE PESTICIDE, TEMPERATURE AND OTHER CLIMATIC CONDITIONS. OTHER FACTORS SUCH AS THE DEGRADATION OF CHEMICALS BY SUNLIGHT AND OXYGEN, AND BY ACID AND MICROBIAL ENZYME ACTION, LEACHING, AND UPTAKE BY PLANTS CONTRIBUTE TO THE ABILITY OF THE PRODUCT TO REACH WATER SUPPLIES. DATA ON THESE ASPECTS IS REQUIRED AS PART OF OUR REGISTRATION PROCESS, WHICH I'LL EXPLAIN FURTHER IN A FEW MOMENTS. THE ROUTES OF PESTICIDE ENTRANCE INTO WATER ARE OF COURSE VARIED, AND I THINK IT WOULD BE BENEFICIAL TO SUMMARIZE THESE POTENTIAL SOURCES FOR A MOMENT.

FIRST, AND MOST OBVIOUSLY, PESTICIDES CAN ENTER WATER SOURCES AS A RESULT OF DIRECT APPLICATION. MANY ORGANIC PESTICIDES ARE ADDED DIRECTLY TO WATER TO CONTROL AQUATIC INSECTS, TRASH FISH, AND AQUATIC

PLANTS. MOST OF THESE APPLICATIONS ARE MADE FOR A PARTICULAR PURPOSE AND THE AMOUNT OF PESTICIDE ADDED IS CLOSELY CONTROLLED. OF CONCERN, HOWEVER, IS THE POSSIBILITY THAT CONTROL CAN BE LAX IN MASSIVE APPLICATIONS, SUCH AS EMERGENCY MOSQUITO CONTROL EFFORTS. IN SOME CASES, TOO, NON-TARGET SPECIES MAY BE ADVERSELY AFFECTED IN MAN'S ATTEMPT TO CONTROL THE TARGET INSECT, FISH, OR PLANTS. DITCH BANK WEED CONTROL PROVIDES AN EXAMPLE OF PESTICIDE USE WHICH, AT LEAST IN THE ARID WEST, MIGHT BE REDUCED COMPATIBLE WITH OBJECTIVES OF WATER CONSERVATION AND SALINITY REDUCTION BY CANAL LINING AND ALTERNATIVE IRRIGATION TECHNIQUES.

A SECOND ROUTE OF EXPOSURE IS AGRICULTURAL AND URBAN LAND DRAINAGE. NOT ALL PESTICIDES APPLIED TO LAND END UP IN A WATERWAY, BUT IT IS LIKELY THAT THE MAJORITY OF THE PESTICIDES IN STREAMS RESULT FROM STORM RUNOFF OR OVERLAND FLOW. PESTICIDES ARE USED FOR MANY OUTDOOR PURPOSES, NOT ONLY IN AGRICULTURAL AREAS, BUT ALSO IN PARKS, GOLF COURSES, HOME LAWNS, AND GARDENS IN URBAN AREAS. SOLUBLE PESTICIDES MAY ENTER SURFACE WATERS DISSOLVED IN DRAINAGE WATER. HOWEVER, IT IS BELIEVED THAT MOST OF THE PESTICIDES REACH WATER WITH

SEDIMENTS WASHED FROM THE LAND. PESTICIDES CAN BE TRANSPORTED, OF COURSE, WHEN THEY ARE BOUND ONTO PARTICULATE MATTER OR OTHERWISE BOUND TO SOIL.

SOIL EROSION IS ONE OF THE PRINCIPAL MEANS BY WHICH BOUND PESTICIDE RESIDUES CAN TRAVEL FROM THE SITE OF APPLICATION. IT IS ESTIMATED THAT APPROXIMATELY FOUR BILLION TONS OF GROSS SEDIMENT ARE ERODED IN THE UNITED STATES EACH YEAR. AS YOU KNOW, THIS LOSS OCCURS BY THE PROCESSES OF SHEET EROSION, GULLYING, AND STREAM CHANNEL EROSION. ERODED SOILS PREVIOUSLY TREATED WITH PESTICIDES ARE MAJOR SOURCES OF SURFACE WATER CONTAMINATION. AGRICULTURAL PROGRAMS AIMED AT REDUCED EROSION CAN BE BENEFICIAL IN REDUCTION OF PESTICIDES FROM THIS SOURCE.

RUNOFF IS ANOTHER SIGNIFICANT CONTRIBUTOR TO THE ADDITION OF PESTICIDES TO WATER SOURCES. THE GREATEST DANGER FROM RUNOFF OF SOLUBLE PESTICIDES IS IN THE PERIOD IMMEDIATELY FOLLOWING APPLICATION AND PRIOR TO THE TIME THESE SUBSTANCES ARE FIXED TO THE SOIL. AS I HAVE STATED EARLIER, THERE ARE MANY FACTORS WHICH AFFECT THE PROPENSITY OF ANY PRODUCT TO RUNOFF. FOR INSTANCE, THE MOISTURE CONTENT OF THE SOIL, AS WELL AS THE INTENSITY AND FREQUENCY OF RAINFALL, AFFECTS THE

OVERALL MOVEMENT OF PESTICIDES IN THE SOIL. A LOW MOISTURE CONTENT FAVORS RETENTION OF THE PESTICIDE IN SOIL. STUDIES ON HERBICIDE MOVEMENTS HAVE INDICATED THAT THE FREQUENCY, LENGTH, AND INTENSITY OF RAINFALL MUST BE CONSIDERED TOGETHER IN PROJECTING PESTICIDE LOSSES. CERTAIN PESTICIDES ARE LEACHED IN GREATER AMOUNTS AND TO GREATER DEPTHS UNDER LOWER RAINFALL INTENSITIES. OTHER STUDIES HAVE INDICATED THAT WEATHER PATTERNS MAY BE AS IMPORTANT AS TOTAL RAINFALL IN DETERMINING THE MOVEMENT OF HERBICIDES IN SOIL. THESE MYRIAD FACTORS ARE CONTINUALLY BEING STUDIED SO THAT WE MAY BETTER UNDERSTAND THE FATE OF PESTICIDE APPLICATION IN THE SOIL. AGAIN, IT SEEMS LOGICAL THAT AGRICULTURAL PRACTICES IN BOTH PESTICIDE USE AND SOIL CONSERVATION PRACTICES CAN PLAY AN IMPORTANT ROLE IN REDUCING RESIDUE TRANSFER.

A THIRD AREA OF POTENTIAL PESTICIDE MOVEMENT TO WATER IS THROUGH ATMOSPHERIC PROCESSES. PESTICIDAL COMPOUNDS MAY ENTER THE ATMOSPHERE IN SEVERAL WAYS AND IN VARIOUS PHYSICAL STATES AND THEN BE REDEPOSITED DIRECTLY OR INDIRECTLY INTO THE AQUATIC ENVIRONMENT. FOR INSTANCE, DIRECT DRIFT FROM SPRAYING OPERATIONS CAN CONTRIBUTE PARTICULATE OR GLOBULAR MATTER; OR, SEVERAL

PESTICIDES, SUCH AS ORGANOCHLORINE INSECTICIDES, CAN VOLATIZE FROM TREATED SOILS, THUS ADDING A SLOW BUT LONG-TERM RESIDUE SOURCE WHICH CAN BE CARRIED BY THE WIND AND REDEPOSITED AT SITES FAR FROM APPLICATION.

A FOURTH WAY IN WHICH PESTICIDES CAN ENTER THE AQUATIC ENVIRONMENT IS THROUGH ACCIDENTS AND IMPROPER DISPOSAL TECHNIQUES. DISPOSAL NEED NOT BE DIRECTLY TO WATER TO ACHIEVE ADVERSE EFFECTS; LAND DISPOSAL PRACTICES TOO CAN LEAD TO EVENTUAL TRANSFER TO WATER. OCCURRENCES OF THIS NATURE ARE WELL DOCUMENTED, AND IN FACT WERE ONE OF THE REASONS THAT THE CONGRESS FELT A GREAT NEED TO AMEND THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA) IN 1972, WHICH I WILL DISCUSS FURTHER IN A FEW MOMENTS. WE BELIEVE THAT PROPER EDUCATION OF AGRICULTURAL USERS CAN DO MUCH TO REDUCE THESE SOURCES.

NOW THAT I'VE REVIEWED THE PRINCIPAL ROUTES OF ENTRY OF PESTICIDES INTO WATER, I FEEL IT ONLY LOGICAL TO EXPLAIN WHAT WE IN THE OFFICE OF PESTICIDE PROGRAMS ARE DOING IN THE AREA OF DETECTING AND MONITORING THESE CHEMICALS IN OUR WATERWAYS. AS MANY OF YOU KNOW, THE NATIONAL WATER MONITORING PROGRAM FOR PESTICIDES WAS ORIGINALLY CONDUCTED BY THE U. S. PUBLIC HEALTH

SERVICE. AS OF 1973, THE PROGRAM HAS BEEN JOINTLY SPONSORED BY THE U. S. GEOLOGICAL SURVEY -- WHICH COLLECTS THE SAMPLES -- AND EPA, WHICH ANALYZES THE SAMPLES. THERE IS A 162 STATION NETWORK DESIGNED TO SAMPLE SURFACE WATERS AND SEDIMENT IN ORDER TO ESTABLISH BASELINE RESIDUE LEVELS AND CHANGES THEREFROM. WATER SAMPLES ARE COLLECTED QUARTERLY, AND SEDIMENT SAMPLES GATHERED SEMI-ANNUALLY.

THE GEOLOGICAL SURVEY PERSONNEL NORMALLY COMPOSITE SEVERAL DEPTH INTEGRATED WATER SAMPLES FROM THE CROSS SECTION OF A STREAM. ALL SAMPLES ARE SENT TO THE EPA PESTICIDE MONITORING LABORATORY AT BAY ST. LOUIS, MISSISSIPPI, FOR ANALYSIS. SOIL AND WATER SAMPLES ARE ANALYZED FOR CHLORINATED HYDROCARBONS, ORGANOPHOSPHATES, AND PHENOXY HERBICIDES. WE ARE HOPEFUL OF EXPANDING THIS PROGRAM THIS YEAR.

WE ALSO CONDUCT A NATIONAL ESTUARINE MONITORING PROGRAM WHICH IS INTENDED TO DETERMINE THE PRESENCE, OR ABSENCE, OF PERSISTENT PESTICIDE RESIDUES, ESTABLISH BASELINE RESIDUE LEVELS, AND DETECT TRENDS. THE PROGRAM WAS INITIATED IN 1965 BY THE GULF BREEZE LABORATORY, WHICH WAS THEN A PART OF THE BUREAU OF COMMERCIAL FISHERIES IN THE DEPARTMENT OF THE INTERIOR.

THE PROGRAM TODAY INVOLVES THE SEMI-ANNUAL COLLECTION OF COMPOSITE SAMPLES OF HERBIVOROUS AND CARNIVOROUS FISH FROM 113 ESTUARIES IN THE UNITED STATES, THE VIRGIN ISLANDS, AND PUERTO RICO. SAMPLES OF FISH ARE COLLECTED THROUGH CONTRACTS AND VOLUNTARY ASSISTANCE BY STATE AND UNIVERSITY PERSONNEL.

ALL SAMPLES ARE CURRENTLY ANALYZED FOR ORGANOCHLORINES, ORGANOPHOSPHATES, PHENOXY HERBICIDES, PCB'S, AND MERCURY. RESULTS OF THESE ANALYSES ARE PUBLISHED, AND ARE OF CONSIDERABLE INTERNAL VALUE TO THE AGENCY IN ASSESSING TRENDS OF ENVIRONMENTAL CONTAMINANTS.

EPA ALSO, IN COOPERATION WITH USDA, OPERATES A SOIL MONITORING PROGRAM WHICH EXAMINES PESTICIDE APPLICATION RATES, CROP UPTAKE AND SOIL RESIDUE. USDA PERSONNEL COLLECT THE SAMPLES AND USE DATA, AND EPA PERFORMS THE RESIDUE ANALYSES. ALL SOIL SAMPLES ARE ANALYZED FOR ARSENIC, CHLORINATED HYDROCARBONS, ORGANOPHOSPHATES, AND TRIOZINES. SAMPLES ARE ALSO ANALYZED FOR PHENOXY HERBICIDES WHEN RECORDS INDICATE APPLICATION HAS BEEN MADE. CROP SAMPLES ARE ROUTINELY ANALYZED FOR CHLORINATED HYDROCARBONS AND ORGANOPHOSPHATES, WHILE TRIAZINE AND PHENOXY HERBICIDE

ANALYSES ARE PERFORMED IF THERE IS A RECORD OF THEIR USE.

IN ADDITION, WHERE THE PARTICULAR CHARACTERISTICS OF THE PESTICIDE RAISE QUESTIONS ABOUT ITS MOBILITY IN CERTAIN SOIL TYPES WITH A POTENTIAL FOR EASY TRANSFER TO WATER, SPECIAL MONITORING PROJECTS ARE UNDERTAKEN. AN EXAMPLE OF SUCH PROJECTS IS THE PICLORAM STUDY IN TEXAS.

AN EXTREMELY IMPORTANT FACET OF THE EPA PESTICIDES STRATEGY IS THE DEVELOPMENT OF CONCEPTUAL MODELS WHICH WILL RELATE THESE VARIOUS PIECES OF MONITORING INFORMATION INTO AN ENVIRONMENTAL SYSTEMS APPROACH.

ONE DANGER IN DESIGNING MONITORING PROGRAMS IS THE POTENTIAL FOR MONITORING THE WRONG THINGS. THE EXTENSION SERVICE IS IN THE FOREFRONT OF KNOWLEDGE RELATED TO PESTICIDES IN CURRENT USE BY FARMERS, THOSE WHOSE USE HAS BEEN CURTAILED, AND THOSE WHICH ARE THE MOST LIKELY TO BE USED HEAVILY IN THE FUTURE. THIS EXPERTISE CAN MAKE IMPORTANT CONTRIBUTIONS TO THE PROPER DESIGN AND CONSEQUENTLY THE VALUE OF OUR MONITORING EFFORTS.

THE OFFICE OF PESTICIDE PROGRAMS, OF COURSE, ATTEMPTS TO MINIMIZE THE ESCAPE OF APPLIED PESTICIDES INTO THE ENVIRONMENT AS MUCH AS POSSIBLE THROUGH THE INITIAL REGISTRATION OF A PESTICIDE. ENVIRONMENTAL DATA REQUIREMENTS WERE DEVELOPED BEGINNING IN THE EARLY '60'S AND FINALLY ARTICULATED IN STANDARDS IN 1970. ALL APPLICATIONS INVOLVING NEW CHEMICALS OR CHANGED USE PATTERNS OF ESTABLISHED CHEMICALS ARE SUBJECT TO DATA REQUIREMENTS DEMONSTRATING SEVERAL IMPORTANT CHARACTERISTICS AS FOLLOWS:

1. THE RATE OF DISSIPATION OF THE PESTICIDE IN THE SOIL. STUDIES DEMONSTRATE THE LENGTH OF TIME INVOLVED FOR THE PARENT COMPOUND AND DEGRADATION PRODUCTS TO BE REDUCED TO SMALL PERCENTAGES OF THE ORIGINAL APPLICATION. IF THE PROPOSED USE PATTERN INDICATES, STUDIES MUST BE CONDUCTED WITH REPEATED APPLICATIONS OF THE SUBJECT PRODUCT.

2. THE MECHANISM OF DEGRADATION OF THE PESTICIDE RESIDUES. THESE STUDIES ARE OFTEN FIELD STUDIES WHICH DEMONSTRATE SUCH FACTORS AS:

A. PHOTODECOMPOSITION IN SOIL AND WATER

B. DEGRADATION AND METABOLISM FROM THE PRESENCE OF MICROORGANISMS

C. HYDRADATION IN WATER

D. DURATION OF THE BIOLOGICAL ACTIVITY

3. THE PROPENSITY OF THE CHEMICAL TO LEACH IN THE SOIL.

4. THE PROPENSITY OF THE CHEMICAL TO MOVE FROM THE SITE OF APPLICATION.

5. THE PROPENSITY OF THE CHEMICAL TO BE BOUND IN SOIL. IF RADIOCHEMICAL TRACER OR OTHER STUDIES INDICATE THAT THE PESTICIDE IS BOUND, ADDITIONAL STUDIES ARE REQUIRED TO

A. IDENTIFY THE RESIDUE

B. DEMONSTRATE THE PHYTOTOXICITY OF THE RESIDUE

C. DETERMINE WHETHER BOUND RESIDUES MAY BE RELEASED FROM THE SOIL BY PLANTS OTHER THAN THOSE INITIALLY GROWN IN TREATED AREAS, SUCH AS ROTATIONAL CROPS.

AND FINALLY

6. THE PROPENSITY OF THE CHEMICAL TO ACCUMULATE IN THE FOOD CHAIN. STUDIES IN THIS AREA INVOLVE FEEDING THE PESTICIDE, PRIMARILY, TO FISH, AND EXAMINING THE TISSUE OF THE SUBJECT SPECIES FOR RESIDUES OF THE CHEMICAL OR ITS METABOLITES.

ENVIRONMENTAL DATA REQUIREMENTS ARE BEING FURTHER DEFINED IN OUR REGULATIONS TO IMPLEMENT SECTION 3 OF THE AMENDED FIFRA, AND IN THE MAJOR REVISION OF THE "GUIDELINES FOR REGISTERING PESTICIDES IN THE UNITED STATES," WHICH WE HOPE TO COMPLETE THIS FALL.

BEFORE CLOSING, I WOULD LIKE TO BRIEFLY DISCUSS THE IMPACT OF THE 1972 AMENDMENTS TO FIFRA, AND THEIR IMPLICATIONS CONCERNING NON-POINT SOURCES OF WATER POLLUTION. THE PURPOSE OF THE AMENDMENTS TO THE LEGISLATION CAN, I BELIEVE, BE SUCCINTLY STATED BY THIS QUOTATION FROM THE HOUSE AGRICULTURE COMMTTEE´S REPORT ON THE BILL:

> THE COMMITTEE FOUND THE GREATEST NEED FOR REVISION OF EXISTING LAWS TO BE IN THE AREAS OF STRENGTHENING REGULATORY CONTROL ON THE USES AND USERS OF PESTICIDES; SPEEDING UP PROCEDURES FOR BARRING PESTICIDES FOUND TO BE UNDESIRABLE; STREAMLINING PROCEDURES FOR MAKING NEW MEASURES, PROCEDURES, AND MATERIALS BROADLY AVAILABLE; STRENGTHENING ENFORCEMENT PROCEDURES TO PROTECT AGAINST MISUSE OF THESE BIOLOGICALLY EFFECTIVE MATERIALS; AND CREATING AN ADMINISTRATIVE AND LEGAL FRAMEWORK UNDER WHICH CONTINUED RESEARCH CAN PRODUCE MORE KNOWLEDGE ABOUT BETTER WAYS TO USE EXISTING PESTICIDES AS WELL AS DEVELOPING ALTERNATIVE MATERIALS AND METHODS OF PEST CONTROL . . . OLD FIFRA IS CHANGED FROM A LABELING TO A REGULATORY PROGRAM.

THE NEW FIFRA FOR THE FIRST TIME MAKES MISUSE OF PESTICIDE PRODUCTS AN ILLEGAL ACT, PUNISHABLE BY CIVIL

AND CRIMINAL PENALTIES. FOR THE FIRST TIME, TOO, PESTICIDES WILL BE CLASSIFIED FOR GENERAL OR RESTRICTED USE, WITH THOSE IN THE RESTRICTED CATEGORY LIMITED TO USE BY CERTIFIED APPLICATORS OR ANY OTHER RESTRICTONS DEEMED APPROPRIATE BY THE ADMINISTRATOR. INTRASTATE PRODUCTS AS WELL AS THOSE SHIPPED IN INTERSTATE COMMERCE WILL BE SUBJECT TO REGISTRATION. IN SHORT, THE NEW ACT PROVIDES THE AGENCY WITH SIGNIFICANTLY STRENGTHENED POWERS TO CONTROL THE FATE OF PESTICIDE CHEMICALS THROUGH TIGHTER REGULATON AND ENFORCEMENT RECOURSES. THE MOST HAZARDOUS MATERIALS, IN TERMS OF POTENTIAL HARM TO THE APPLICATOR OR TO THE ENVIRONMENT, WILL BE USED ONLY BY THOSE WHO HAVE DEMONSTRATED COMPETENCE TO HANDLE THESE PRODUCTS PROPERLY. THESE PROVISIONS, WILL, WE ANTICIPATE, MINIMIZE MISUSE, OVERUSE, ACCIDENTAL SPILLS, AND IMPROPER DISPOSAL OF PESTICIDE PRODUCTS. THE NEW LAW, FURTHER, AUTHORIZES THE AGENCY TO REGULATE PESTICIDE DISPOSAL IN GENERAL, AND WE HAVE ALREADY PUBLISHED SOME GUIDANCE IN THIS AREA IN THE FEDERAL REGISTER.

THE OFFICE OF PESTICIDE PROGRAMS INTENDS TO EXERCISE ITS NEW REGULATORY AUTHORITY IN A MANNER WHICH STRIVES TO ENSURE THAT PESTICIDES ARE USED

INTELLIGENTLY, JUDICIOUSLY, AND WITHOUT "UNREASONABLE EFFECTS ON MAN AND THE ENVIRONMENT." THIS CONCEPT IS FOREMOST IN OUR THOUGHTS AS WE DEVELOP REGULATIONS TO IMPLEMENT THE NEW LEGISLATION. WE ARE CONFIDENT THAT THE STEPS WE ARE TAKING TO MINIMIZE THE ADVERSE EFFECTS OF PESTICIDE PRODUCTS, BOTH THROUGH OUR REGULATORY INVOLVEMENT AND THROUGH HELPING FUND SUCH ACTIVITIES AS INTEGRATED PEST MANAGEMENT RESEARCH, WILL RESULT IN WISER USE AND FEWER MISHAPS INVOLVING THESE CHEMICALS, AND IMPROVED QUALITY OF OUR EARTH, AIR, AND WATER RESOURCES.

EPA AND USDA HAVE ENTERED INTO INTERAGENCY AGREEMENTS AT THE NATIONAL LEVEL TO BEST UTILIZE THE CAPABILITIES OF EACH AGENCY IN ANALYSIS OF ENVIRONMENTAL IMPACTS, ECONOMIC AND PRODUCTION EFFECTS, PROBLEM SOLUTIONS, AND, MOST IMPORTANTLY, MECHANISMS FOR INSTITUTIONAL CHANGE IN ADDRESSING THESE AREAS OF CONCERN. REGIONAL OFFICES OF EPA HAVE BEEN AUGMENTING THESE NATIONAL AGREEMENTS ON A MORE SPECIALIZED BASIS WITH COOPERATIVE STATE EXTENSION SERVICES. SUCH ACTIVITIES HAVE BEEN ACCOMPLISHED IN MANY CASES, BUT WE NEED TO GO FARTHER. THIS CONFERENCE PROVIDES AN OPPORTUNITY TO BETTER DELINEATE POTENTIAL AVENUES OF

COOPERATION AND MUTUAL EFFORT. ALONG THESE LINES, THE EXTENSION SERVICE HAS A POTENTIALLY MAJOR ROLE TO PLAY WITH RESPECT TO REDUCING PESTICIDE CONTAMINATION OF OUR WATER RESOURCES BY ASSURING, THROUGH ITS UNEQUALED CAPACITY FOR TECHNOLOGY TRANSFER,

- THAT SOUND USE OF PESTICIDES IS PRACTICED IN AGRICULTURE,
- THAT TRAINING OF APPLICATORS FOR RESTRICTED USE PESTICIDES IS CARRIED FORTH IN AN EXPEDITIOUS FASHION,
- THAT REDUCTION IN PESTICIDE USE IS ACHIEVED WHERE IPM TECHNIQUES MAKE THIS FEASIBLE AND ENVIRONMENTALLY DESIRABLE. IPM HAS IN MANY CASES BEEN SHOWN ADVANTAGEOUS, BUT INSTITUTIONAL SOLUTIONS IN REACHING GROWERS SEEMS TO LAG.

IN TURN, EPA HAS THE RESPONSIBILITY TO LOOK CLOSELY AND REALISTICALLY AT THE POTENTIAL ADVERSE CONSEQUENCES OF PESTICIDE USE AND APPROACH ITS REGULATORY MISSION REALISTICALLY, IN TERMS OF BOTH THE BENEFITS AND COSTS OF PESTICIDES TO THE AGRICULTURAL COMMUNITY AND TO SOCIETY AT LARGE.

IF WE IN EPA AND USDA DO NOT MUTUALLY MESH OUR RESPECTIVE MANDATES TO THE BENEFIT OF MAN AND THE ENVIRONMENT, OUR SOCIETY AS A WHOLE CAN ONLY STAND TO

BE THE LOSER.

I APPRECIATE THE OPPORTUNITY TO DISCUSS OUR PROGRAM WITH YOU TODAY, AND WILL BE HAPPY TO ANSWER ANY QUESTIONS YOU MAY HAVE. THANK YOU.

Agricultural Water Pollution Control - A Regional Perspective*

by

Francis T. Mayo**

We, in the Environmental Protection Agency, appreciate the opportunity to meet with the Extension Service and discuss nonpoint source pollution problems, and to develop firm communications for the agricultural role in helping solve environmental problems.

Region V covers the States of Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. We have initiated several programs which involve the Extension Service and I would like to state the success we are having with these programs can be attributed to your efforts and cooperation.

Our first meeting, with the Extension Directors, was called on June 3, 1973. From this conference, we set in motion our working relationship with the Extension. The agenda for the conference was simple and informal. We covered EPA's organizational structure and followed with specific programs, such as the (1) permit program; (2) solid waste; (3) pesticides; (4) research; (5) livestock feedlots, and (6) erosion.

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*To be presented at the Agricultural Nonpoint Source Water Pollution Control Workshop, Mayflower Hotel, Colonial Room, Washington, D. C., September 16-17, 1974.

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Scope of Nonpoint Source Program within Region V

Our nonpoint source pollution program in Region V does not have a specific identity as such, but crosses over several divisional lines. The most active program at the present is the International Joint Commission. This is a joint agreement between the United States and Canada. Included in this program is the Sec. 108 program which also addresses itself to pollution control of the Great Lakes. Under these programs, we have committed $11.9 million to seven projects. We class all of these programs as nonpoint in nature and they will also satisfy the requirements of the Water Bill (P.L. 92-500).

The Surveillance and Analysis Division is involved in the Great Lakes by developing programs, furnishing project directors, computing sediment loadings, and setting up the data to be stored and analyzed by STORET.

In our Air and Water Programs Division we have planners and a special section on interagency planning which meets with State and Federal agencies. The guidance for this program falls under Secs. 208, 303, 304 and 305(b) of the Water Bill (P.L. 92-500). I believe these sections are particularly important to our cooperative effort to control water pollution. These sections not only provide insight into what are nonpoint sources, but also set a pattern for the implementation of our common programs.

Probably the greatest input from Extension would be related to agricultural permits in EPA. On May 3, 1973, proposed rule-making was published in the Federal Register covering livestock. This established who must apply for an NPDES permit, and the rules covering the large operators in livestock feeding. Thus, we must finally address the problem of small feeders and Extension must play a major role to help develop the standards and engineering designs that will reduce the pollution. But, the major thrust later will be the educational materials with meetings to implement the concepts.

To be more specific about our programs, I will give you a brief review of our pilot control projects and studies.

Black Creek Pilot Control Project #1

The Black Creek Project is located Northeast of Fort Wayne in Allen County, Indiana, and is a tributary to the Maumee River Basin. The purpose of the project is to assess the Environmental Impact of Land Use on Water Quality. The prime contract was made with the Allen County Soil and Water Conservation District for $1.9 million over a five-year period. This District Board in turn subcontracts, by agreements, with Purdue University for the research, and with the Soil Conservation Service for planning and technical assistance. This watershed has approximately 170 farm families, and a contract is written with each farm family to install farm and structural practices for water quality improvement.

The major participants include local, county, State, and Federal agencies all cooperating to make this project function.

The project has been operating for over a year. From the Black Creek project, we have released two publications. The first one was the work plan entitled, "Environmental Impact of Land Use on Water Quality" and the second publication is an "Operating Manual". These publications have been distributed to you at this Conference.

I would like to elaborate briefly on the "Operations Manual" because this publication gives the details of just how this project is conducted.

The first thing you will note on the second and third pages is a list of principal participants. You can see it's quite extensive.

The handbook contains the basic policies, regulations and specifications for the administration of the Black Creek Project.

It is hoped that the data obtained from this study can be applied specifically to the Maumee River Basin, and, in general, to other areas to reduce sedimentation and improve water quality.

Under administrative heading, we define areas of authority and responsibility of all participants in the project and give a typical flow diagram of the grant process.

The application section gives who and what land is eligible with a procedure for the farmers to apply for assistance. A priority system was developed to expedite the program.

For the plan of operation, we describe the selection of conservation practices and give details on the development of 5-year plans with the farmer and farmer groups. We define the procedure for plan approval and certification by contracting officer.

Under the section on contracts, the legal aspects are given such as contract modification, termination, termination by mutual consent, violations, compliance, and appeals. We also give a procedure for group contracting.

The handbook gives cost-sharing for each approved practice and defines cost-sharing not subject to claims.

Research to be carried out on the project is given in detail such as the goals, techniques, monitoring, surface flow, and subsurface flow. The type of stage recorders has been given with the location of the rain gauges. We also give what elements will be tested for and the analytical procedures to be used. Other research includes tillage trials with rainulator (simulated rainfall) tests on each tillage practice. Modeling and prediction with data management is described. Also gives biological studies and fish collection. Throughout the project, a social-economic study will be conducted.

In the Appendix of the handbook, examples of all agreements, contracts and project accounting formats are exhibited.

Pilot Control Project #2 - Western Lake Superior Basin Erosion-Sediment Control Program (Minnesota and Wisconsin)

This project will cover the famous Red Clay Area. The soils are very unstable and are a source of pollution into Lake Superior and the Harbor of Superior, Wisconsin.

The planning of this project is extremely complicated due to the fact that it will involve two States and five counties. Here again, we have asked for the cooperation of many local organizations, county, State and Federal agencies, and have received their enthusiastic participation.

The project has been funded by EPA for $2.7 million over a 4-year period. A plan of implementation will be developed shortly.

Pilot Control Project #3 - Menomonee River Basin (Wisconsin)

Our third pilot control project in the erosion-sediment control field is located on the Menomonee River in Wisconsin. The major thrust of this project will be to develop and implement a sediment control ordinance with institutional arrangements developed initiating control methodology on urban and rural lands.

The project has been funded from Sec. 108 funds for $2.2 million and is in the planning stage.

All three projects I have spoke of are implementing programs with concurrent research. The projects are not study or state-of-the-art programs.

International Joint Commission - Michigan State University Sub-Basins ($953,000 Additional)

Methodology

Felton-Herron Creek Subwatershed Studies (Tasks 1-4): As part of the study plan for the Felton-Herron Creek Program, Michigan State University investigators will look, in detail, at the entire cycle of water reaching the land, its modifications while on the land, and the quality of the water and associated materials as they leave the land and enter the receiving watercourse. The physical facilities now available for this study are uniquely suited for an in-depth evaluation of liquid irrigation sites.

The facility, covering approximately one square mile, constitutes the majority of a well defined watershed and includes a diverse array of soils quite typical of the Great Lakes States. Conceptually, and from an analytical viewpoint, this area represents a microcosm for most land irrigation sites in the Great Lakes Basin.

Available will be flexibility in stressing the spray irrigation site with an array of water application regimes and water qualities, ranging from almost continuous application to no application above that of natural rainfall. Quality can be varied from that of a poor quality secondary effluent to application of water treated to high purity and low solids concentration. Under this system, nearly all of the recognized types of application of water to land can be evaluated with concurrent measurement of stress effects. Included would be the response of a broad array of vegetative types, rate and quality of runoff from these vegetative types, effectiveness of different soils, and effects on macro and microclimate. The transport of water through underground systems can be measured on both tilled and untilled areas. Through a series of 64 monitoring wells (now installed) it will be possible to thoroughly characterize vertical and lateral water dispersion. In addition, the chemical constituents of the applied water can be traced through the soil mantle and on into the entrace to the potable water aquifer or as it may be discharged in the form of springs to the nearest watercourse.

The public health aspects of runoff and groundwater will be examined in detail. Programs now underway have already perfected a variety of virus isolation techniques and these are now being applied to surface and groundwater in the area for necessary background information.

Within the Felton-Herron Creek watershed are two well-defined microwatersheds of size and design to enable the partitioning of runoff due to independent treatments. Tested here will be variables that in a larger system would be possible to conduct detailed analyses of the effects of ground vegetation of water quality and effect of cropping procedures on the ground vegetation itself or to the quality of the water leaving the watershed. Within the microwatersheds and throughout the entire area will be an extensive network of climatic and water quality monitoring instrumentation. Weighing and non-weighing lysimeters will be installed to provide invaluable information on evapotranspiration, a little understood but extremely important variable in water balance studies.

Mill Creek Subwatershed Studies (Tasks 5-6): Activities for this phase of the subwatershed program will focus on drainage from a fruit orchard area in Southwestern lower Michigan. This area has been the subject of intensive research activity in recent years and with supplemental funding for hydrolocal studies and increased sampling activity the output of results applicable to IJC objectives will be greatly accelerated.

This area is extremely important because of its heavy pesticide use pattern and the subsequent implications of the ranslocation of the pesticides into the Great Lakes via runoff and/or evaporation and subsequent precipitation. Of special importance is the persistence of the newer pesticides that are replacing the chlorinated hydrocarbons and how far they move in a watershed system.

WIND EROSION AND SEDIMENTATION

Neil Woodruff

I. Introduction

A. Assignment

Provide background information on magnitude of problem, consequences and hazards from blowing soil, and methods of control.

B. Modus operandi

Define and discuss reasons for occurrence, areal extent, quantities of soil transported, consequences, factors affecting, and principles and methods of control.

II. The Problem

A. Definition and kinds of duststorms

1. Wind erosion is simply removal and transport by wind.
2. Kinds of duststorms are khamsin, haboob, desert, and steppe.
3. Average area involved is 188 square miles.
4. Duration is 6.5 hours.

B. Reasons for occurrence

1. Soil conditions are unprotected, smooth, bare, loose, finely granulated.
2. Kind of agriculture is wheat and sorghum or any crop having large expanses.
3. Winds are strong, exceeding 35 mph at least 2 percent of time, 43 mph for 1 hour each 2 years, 41 mph for 3 hours each 2 years. Magnitudes are high and greater than 400.
4. Droughts occur frequently and there is close correlation with duststorms.

C. Areal extent

1. Locations with wind erosion problems are Great Plains, Great Lakes, Eastern Seaboard, Southeastern Coastal, California, and Northwest.
2. Wind erosion is dominant problem on 70 million acres, 34 percent is adequately protected so 46 million need special practices.

3. Land damaged ranges for last 30 years are 1 to 16 million acres per year. Average is 4.8 million acres per year.

III. Quantities of Soil Transported

A. Modes of transport are surface creep (500 to 1,000 μ), saltation (100 to 500 μ), suspension (less than 100 μ).

B. Proportions in modes are highly variable but in round numbers 20 percent surface creep, 70 percent saltation, 10 percent suspension.

C. Concentrations

1. Individual storms in 1950's ranged from 675 to 280,000 $\mu g/m^3$.

2. Decade of 1950's averaged 4,850 $\mu g/m^3$.

3. Decade of 1960's averaged 3,538 $\mu g/m^3$.

D. Dust passage

1. 1950's averaged 61 x 10^3 tons/vertical $mile^2$.

2. 1960's averaged 13 x 10^3 tons/vertical $mile^2$.

E. Dust particulate loads

1. 1950's averaged 37 to 551 million tons/year with a 244 million ton/year average.

2. 1960's averaged 77 million tons/year.

F. Deposition

1. Available estimates in 1950's indicate 1.5 tons/acre average.

2. In 1960's, measurements showed deposition dependent on distance from heart of old dust bowl. It averaged 1,164 close in and 7 pounds per acre per month at distances greater than 1,000 miles.

G. Saltation and surface creep transport

Depends on climate and size of areas. Bad years and large areas average 25 tons per acre. Good years and large areas average 2 tons per acre per year. Individual fields may lose 75 to 350 tons per acre per year.

IV. Consequences

A. Pollutes air, and concentrations far exceed 80 $\mu g/m^3$, considered tolerable.

B. Removes silt, clay, organic matter, and plant nutrients, thus lowering land productivity.

C. Causes auto accidents.

D. Interferes with air travel; buries fences, ditches, and roads; fouls machinery and electrical switching apparatus, etc.

E. Pollutes water

1. When soil materials eroded by wind are blown into drainage ditches, streams, lakes, and reservoirs, or are dropped back to earth's surface, water may be polluted.

2. Relative importance

a. Wind erosion is a minor contributor to water pollution compared to water erosion.

b. Worldwide sediment delivery to oceans ranges from 66 to 397 million tons per year or only about 1 percent of total delivery from other sources.

c. In the United States, good estimates of the proportion of windblown materials going to inland waters are not available but it is estimated that 154 million tons per year during periods of low wind erosion incidence and 488 million tons per year during high incidence are equally deposited over land and water areas. However, this is less than 4 percent and about 12 percent, respectively, of the estimated 4 billion tons of sediment washed into streams each year. Short distance transport in surface creep and saltation into drainageways may indirectly contribute an additional 480,000 tons per year during low wind erosion incident years and 6.0×10^6 tons per year during high erosion incident years.

3. Contaminates other than soil particles

a. In addition to soil particles, wind may carry plant nutrients, animal wastes, residues from burning, and pesticides.

b. Conclusive data on quantities and extent of adsorption of pesticides on dust particles is lacking; however, some measurements indicate a low (14 ppb) hazard from dust contaminated with insecticide.

V. Factors Affecting Wind Erosion

A. Major factors affecting the amount of wind erosion from a given field are soil cloddiness, surface roughness, windspeed and direction, soil moisture, field length, and vegetative cover.

1. Clods prevent erosion because they are large enough to resist wind force and they shelter other erodible materials.

2. Roughness alters windspeed by absorbing and deflecting part of wind energy.

3. Erosion decreases as soil moisture increases. Air-dry soil erodes about 1 1/3 times more rapidly than soil at wilting point for plants.

4. The amount of soil loss from given field is determined by distance across field along prevailing wind direction and windspeed. A 30 mph wind is more than 3 times more erosive than 20 mph wind.

5. Living and dead vegetative cover reduces wind erosion by preventing direct force of wind from reaching soil particles and trapping moving particles.

6. Interaction of these factors is expressed in a wind erosion equation: $E = f(I',K',C',L',V)$.

VI. Principles and Methods of Control

A. Principles

1. Establish and maintain vegetative or nonvegetative cover.

2. Produce, or bring to the soil surface, aggregates or clods large enough to resist wind forces.

3. Roughen land surface.

4. Reduce field width along prevailing wind direction.

5. Level or bench land, where economically feasible.

B. Methods of control

Principles of wind erosion control can be applied by following a number of practices--some permanent, some temporary.

1. Establish and maintain vegetative cover.

a. Use stubble mulch or conservation tillage practices with general goal of maintaining as much residue on land in a standing or near erect condition as is compatible with seed planting procedures.

b. Plant cover crops where land is bare between regular crops.

c. Control grazing of both rangeland and winter wheat to prevent complete denuding of vegetation and pulverizing of soil.

d. Use crop rotations in which two or more crops or one crop and fallow are alternated on given area in regular sequence.

e. Regrass and reforest areas such as sand dunes, blowouts, and other unproductive land to prevent spread of erosion to more productive land.

f. Apply hauled-in mulches or nonvegetative and processed covers to areas of severe erosion or to areas with high economic return.

2. Roughen the land surface

   a. Most effective roughness height is 2 to 5 inches.

   b. Conservation tillage leaves rougher than conventional tillage.

   c. Special planters such as deep-furrow drills are especially effective in providing wind-resistant surfaces.

   d. Use emergency tillage as last resort when other means of control fail.

3. Produce soil clods and aggregates

   a. Soil clods larger than 0.84 mm in diameter are resistant to wind erosion.

   b. Degree of cloddiness needed depends on levels of other factors affecting wind erosion and can be calculated with wind erosion equation.

   c. Degree of cloddiness produced by tillage depends on soil texture, soil moisture, speed of operation, and kind of tillage tool.

4. Reduce field widths along prevailing wind direction

    a. Wind erosion is an avalanching process; therefore, any measure that reduces field length along prevailing wind direction reduces erosion.

    b. Use stripcrops oriented at right angles to prevailing winds. Required widths vary with soil texture, cloddiness, roughness, and wind velocity and can be calculated with wind erosion equation.

    c. Use wind barriers of trees and shrubs in 1 to 10 rows, narrow rows of field crops, snow fences, solid wooden or rock walls, and earthen banks. Effectiveness of any barrier depends on wind velocity and direction, and on shape, width, height, and porosity of the barrier.

5. Level or bench land

    a. Land is sometimes leveled or benched for purpose of irrigation, water erosion control, and moisture conservation, and these modifications affect rate and amount of erosion by wind.

    b. Research information on the relationship between land modification and wind erosion is meager but estimates in Great Plains indicate shortening field lengths from 1,000 to 100 feet by benching reduces erosion by 50 percent.

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WATER EROSION AND SEDIMENTATION[1]

Minoru Amemiya[2]

I. Introduction

  A. Erosion-sediment relationships

  B. Consequences of soil erosion

    1. On-site

    2. Off-site

II. Factors affecting soil erosion by water

  A. Soil erosion--a physical process involving detachment and transport of soil material

  B. Universal soil loss equation

    1. Rainfall

    2. Soil properties

    3. Slope length and steepness

    4. Cropping management

    5. Supporting practices

  C. Examples of available research information related to soil erosion by water

    1. Water infiltration and storage

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[1] An outline of material prepared for presentation at the national ECOP-EPA workshop on agricultural non-point source pollution control, September 16-17, 1974, Washington, D.C.

[2] Professor of agronomy and extension agronomist, Iowa State University, Ames, Iowa.

2. Energy considerations

3. Vegetative cover

4. Soil wettability

III. Soil erosion control

A. Objective is to dissipate energy of forces involved

B. Vegetative cover

C. Tillage methods

D. Slope modification

IV. Physical control of sediment

A. Agronomic

B. Structural

V. A program for erosion and sediment control

A. Elements

1. Education

2. Incentives

3. Control

B. USDA and EPA involvement

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Economics of Soil Erosion and Sediment Control on Agricultural Production

By Harold R. Cosper*

The agricultural community has been developing and improving soil conservation practices for a long time. The increased public demand for improving water quality, as evidenced by the Federal Water Pollution Control Act, has brought new focus to soil erosion and sediment control. There are direct and indirect economic consequences that will result from improving the quality of water. An evaluation of the economic implications of reducing soil loss and sediment levels in streams and lakes is critical if Federal and State water quality goals are to be consistent with other goals of our society. I plan to discuss briefly some of the critical economic considerations, economic information that is presently available, and needs for additional information

Economic Concerns

The establishment of water quality standards raises a number of economic questions: (1) What are the most economically efficient controls to achieve improved water quality?; (2) What are the benefits?; and (3) What are the adverse impacts? We need answers to these questions if we are to decide how much society is willing to pay for improved water quality and who should bear the costs. In other words, an appropriate balance between public or social costs and benefits and private costs and benefits must be determined.

The control of erosion and sediment has different impacts on different individuals. A farmer's view of erosion control may differ considerably from that of the sanitary engineer or the fisherman, because they are faced with different sets of cost and benefits. It is essential that the various public and private costs and benefits associated with sediment control be evaluated so that the economic trade-offs among alternative control and sediment levels are known. Only by knowing the economic trade-offs can society decide the appropriate goals, and the policies needed to achieve these goals.

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Soil erosion and sediment loss cause both on-site and off-site damages. The erosion of these soils, the loss of plants nutrients and pesticides resulting from this erosion, and gullying are common on-site damages. Farmers can use a combination of production practices and structures such as conservation tillage, strip cropping, terracing, and diversion to control these damages. If the damages severely affect productivity and income, farmers readily appreciate the direct benefits that would accrue to them by adopting these practices.

Off-site damages include out-of-bank flows and damage to bordering lands and vegetation caused by waterways clogged by sediment. Other adverse impacts of sedimentation (including plant and mineral elements carried on the sediment) are unsuitable habitats for some species of fish, eutrophication of receiving waters and resulting algal blooms, and decreased recreation potential. These damages can be reduced by off-site control methods involving dredging and collection basins. The off-site damages can also be reduced by the use of on-site control practices previously mentioned. However, unless the farmer receives direct benefits, it may be difficult for him to justify adoption of these practices which require additional investment and/or operating capital and make management more complex. Certainly, this is why cost-sharing has been used to encourage on-site conservation practices.

There are other potential impacts than those mentioned above. If decisions were made to set soil loss limits requiring intensive use of control procedures and changes in cropping patterns, adverse regional and national impacts could result. Unless on-site controls and practices are consistent with high levels of productivity and improved farm income, major shifts in total production, composition of production, location of production, and productivity may occur. These effects would, in turn, affect national supplies of food and fiber, consumer prices, foreign trade, domestic consumption patterns. These impacts are critical. Research is underway on these concerns, and more needs to be done. Currently, detailed information on these problems is scanty.

Once the farm, regional and national damages have been assessed attention must focus on another set of economic questions. What are acceptable goals and standards for erosion and sediment control, and how can they be achieved most effectively? This brings us back to the evaluation of trade-offs between public and private benefits and costs. A number of policy options, such as cost-sharing and tax advantages, should be considered if we are to provide the necessary incentives for adoption of erosion control practices.

To date, most of the attention on the economics of soil and sediment control has focused on site-specific farm situations. I am now going to turn to a discussion of some of the site-specific information that has been generated over the years. This type of research and information is important, but we should not lose sight of the fact that aggregate analyses are also critical if we are to meet reasonable environmental quality standards that are consistent with other goals of our society.

Results of Some Site-Specific Economic Studies

Many studies dealing with the economics of soil conservation have been made over the years in many different areas of the country. These studies are site-specific, and a review of the literature reveals the difficulty in generalizing the results of any particular study to other areas. A review also indicates the sensitivity of results to particular assumptions regarding economic and physical variables, such as planning horizons, discount rates, prices and costs, conservation alternatives, and the effects of conservation practices on short- and long-run productivity.

Conservation measures can and frequently do pay off. However, in many cases it is difficult, if not impossible, to project a payoff on an individual farm basis. For example, a study of more than a hundred farms in Northeastern Illinois concluded that conservation measures not only were effective in maintaining soil productivity for future use, but could also add to net farm income. However, these results were obtainable only by increasing the level of inputs and outputs under a higher level of managerial skill (24). A more recent study in the same area considered the relationship between soil loss and crop yield, but excluded changes in production techniques (30, 12). Income per acre declined as the proportion of meadow in the crop rotation on a Swygert soil was increased. However, farming on the contour was always more profitable than farming up and down the slope (Table 1). The study assumed that decreased crop yield caused by increased erosion would not be offset by increased use of fertilizer. A 5.0% discount rate was used in computing the value of the net return from three cropping systems, two planting techniques and four planning horizons.

Two systems were considered--up-and-down slope planting (6% slope) and contour planting using three cropping systems for a 20-year planning period. The difference in per acre net returns was $36 for continuous corn, $14 for a corn-corn/soybean-oat rotation, and $9 for a meadow rotation. Continuous corn grown on the contour gave the highest net return per acre. Soil losses declined with contouring and as the proportion in meadow increased (Table 2). The 2 years of meadow farmed on the contour reduced soil loss by more than one-third of that for continuous corn on the contour on a 6% slope, but with a sacrifice in income of $21 per acre.

Planting and tillage techniques as a means of soil and water conservation had their beginning many years ago (7). However, conservation tillage was not readily accepted by most farmers. Farmers were accustomed to clean-tilled fields and were reluctant to accept the trashy appearance associated with the limited till system. Also, new types of planting equipment were needed, as well as a higher level of farm management.

Reduced Tillage Systems

Reduced tillage, if properly managed produces yields comparable to other tillage methods, reduces tillage costs, and significantly reduces soil losses by erosion (3, 18, 22, 5, 32, 19). Early efforts with conservation tillage sometimes showed yield reduction, due primarily to improper residue placement (23, 16).

Table 1.--Value of accumulated income per acre, by rotation, slope, method of cultivation, and length of planning horizon (discount rate of 5.0%), Northeastern Illinois*

Length of planning horizon in years	Continuous crop				C-C-SB-O-M				C-C-O-M-M			
	Slope				Slope				Slope			
	Up and down		Contouring		Up and down		Contouring		Up and down		Contouring	
	4%	6%	4%	6%	4%	6%	4%	6%	4%	6%	4%	6%
	Dollars											
5	103	79	106	83	89	66	90	67	87	69	88	70
10	177	130	185	143	157	113	159	118	154	120	156	123
20	267	180	289	216	245	170	253	184	246	186	250	195
30	310	192	347	251	295	197	309	221	300	223	307	237

*Swanson, E. R. and C. E. Harshbarger, 1963. *An Economic Analysis of Effects of Soil Loss On Crop Yields*, Journal of Soil and Water Conservation, Vol. 19, No. 5

Table 2.--Annual soil loss estimates from Swygert silt loam soil, by crop rotation and planting systems*

Crop rotation	Planting technique			
	Up and down slope		Contour	
	4% slope	6% slope	4% slope	6% slope
	------------Tons/Acre ----------			
Continuous Corn	18.8	29.2	9.4	14.6
C-C-SB-O-M	7.4	13.6	3.7	6.8
C-C-O-M-M	4.4	8.2	2.2	4.1

*Swanson, E.R. and C.E. Harshbarger, 1963. *An Economic Analysis of Effects of Soil Loss on Crop Yields*. Journal of Soil and Water Conservation, Vol. 19, No. 5.

Conservation tillage procedures require fewer tillage operations, and therefore reduce the cost of operation. Planting and tillage costs with a till plant system on a sandy loam soil in central Nebraska were approximately half the cost of the conventional planting system (34). Planting and tillage costs for conventional planted corn were $14.12, per-acre, lister planting $8.79, and till planting $7.54 (Table 3). The lower costs due to reduced tillage would, to some degree, be counterbalanced by increased herbicide costs. Soil loss from both the no-till and till plant systems was only a fraction of the loss from conventionally tilled field under two simulated storm intensities (Table 4).

Similar studies at the same location for a wheat-fallow rotation indicated yearly per acre field production costs of $7.50 for conventional tillage at $6.25 for the stubble mulch system and $5.25 for the no-till system including herbicide costs (25, 33).

Conventional tillage and stubble mulch tillage for a wheat-fallow rotation were compared in a study for eastern Washington. All production costs were considered. This study concluded that stubble mulch tillage increased production costs $2.15 per acre over the costs for conventional tillage (9). However, a soil loss was reduced 30 to 50 percent.

Terracing

Altering the topography of the land to protect against soil erosion is both complex and costly. Terracing systems not only require a large initial capital outlay for construction, but also a yearly maintenance to insure proper operation.

Various economic studies have been made to determine the economic feasibility of terracing as a soil conservation alternative. A major problem is to obtain reliable estimates of probable yields with and without terracing. In apprasing the economic feasibility and methods and practices to reduce soil loss, the following factors are important.

(1) Length of the planning period,

(2) Difference in yields over the appropriate time period,

(3) The discount rate to be used, and

(4) Product and factor prices over the appropriate time period.

A study of terracing in the southern Piedmont area of North Carolina concluded that benefits exceeded costs only if a low discount rate at or near the 2.5 % level was used for capital investment (11). A similar case study was made of 24 sample farms representing specific situations in the four southern states of North Carolina, South Carolina, Alabama, and Tennessee (10).

Table 3. --Per acre planting and tillage costs for three crop production systems on a sandy loam soil, central Nebraska*

Field Operation	Planting system		
	Conventional	Lister	Till
	---------------- Dollars ----------------		
Cutting Stalks 1/	1.62	1.62	1.62
Disking	1.58	1.58	--
Plowing	3.52	--	--
Harrowing	1.20	--	--
Planting 2/	1.95	2.31	2.64
Rotary hoing	0.97	--	--
Cultivation 3/	1.64	1.64	1.64
Cultivation	1.64	1.64	1.64
Total Cost	14.12	8.79	7.54

*Wittmus, H. D. and N. P. Swanson 1964. Till Planted Corn Reduces Soil Loss. Agricultural Engineering, Vol. 45

1/ Stalk cutting replaces one disking operation
2/ All planters equipped with fertilizer and band application attachments.
3/ Cultivator equipped with fertilizer attachments.

Table 4.--Soil loss from a Bridgeport very fine sandy loam under three tillage systems and two storm intensities, North Platte, Nebraska*

Tillage System	60-minute storm, 2½ inches rain per hour	18-minute storm, 4 inches rain per hour
	------------- Tons/Acre -------------	
Convential tillage	10.7	8.0
Till-plant	3.4	3.2
No-till	0.8	0.4

*Whittmus, H. E. and N. P. Swanson, 1964. Till-planted Corn Reduces Soil Loss. Agricultural Enginerring, Vol. 45

Reduction in soil loss was based on the universal soil loss equation, expanded to the county level for each situation. The study indicated that the costs for terracing were generally greater than benefits received for most of the sample farms. This relationship varied with the interest charge and length of planning period used.

Conservation alternatives, including crop rotation with and without a terracing system, were compared for the Walnut Creek Watershed of northeastern Kansas. Without a soil loss restriction, the most profitable farming system in this study was a fertilized, unterraced rotation.

Table 5 shows construction costs for a terracing system for each of the six soil groups. Total terracing costs, based on 100 acres of cropland, ranged from $2,202 to $2,689.

Table 5.--Terracing construction costs based on 100 acres of cropland with and without ACP payments, Walnut Creek Watershed, Brown County, Kansas*

Soil Type and Slope	Cost of Construction Operator's Cost Without ACP payment	 With ACP payment
	Dollars	
Marshalling and Sharpburg, 2-4%	2,202	755
Marshalling and Sharpburg, 5-7%	2,493	834
Grundy, 2-4%	2,271	774
Grundy 5-7%	2,582	856
Shelby, 5-7%	2,493	834
Shelby, 8-11%	2,689	887

*Micheel, Charles C. and Charles W. Nauheim, 1961, Economics of Soil Conservation Northeastern Kansas. Ag. Econ. Refs. No. 101, Kansas Ag. Experiment Station, Kansas State University, Manhattan, Kansas

Average net return for 100 acres with terraces was $3,446 with an estimated soil loss per acre was estimated of at 9 tons/acre. If the farmer paid an average of $2,455 for terracing to achieve a 5 - ton/acre soil loss level, his net return would be reduced $152. When society paid an average of $1,632 of the terracing cost, leaving $823 for the farmer to pay, these farm net revenue would be reduced only $88. This resulted in an annual private benefit of $64 ($152 minus $88) for a one-time social cost of $1,632.

A study of the Mendota West Fork Watershed in north-central Illinois concluded that annual net income above nonland costs for continuous corn with convential tillage, planted up and down the slope, was $86.15 per acre, with an estimated annual soil loss of 12.66 tons per acre (20). Off-site sediment damages (costs) from this system, based on the cost of dredging, were estimated at $4,525. Plow-planted continuous corn, contoured and terraced, yielded an annual net income above nonland costs of $84.51 per acre, with an annual soil loss of 1.51 tons per acre. Off-site sediment damages (costs), based on dredging costs, were $557. For the watershed as a whole, considering both on-site and off-site effects, the latter system showed $1,601 in annual benefits.

A further sampling of completed research studies would reveal that in many but not all instances, reduction of soil erosion to low levels may increase production costs and reduce net farm incomes. It follows, then, that stringent erosion control could result in lower production and higher consumer food and fiber prices. This is the nature of the trade-off that society must consider, if it wants fewer pollutants in streams.

Summary

Numerous private and public economic impacts are associated with soil erosion and sediment controls to improve water quality. The Federal Water Pollution Control Act dictates that the public benefit from improved water quality, but the magnitude of these benefits has not been determined. Previous economic research on erosion and sediment control has been site specific and does not permit a generalized assessment of the magnitudes of impacts. The research does indicate that in some instances the economic and environmental objectives of erosion complement the objectives of economically efficient food and fiber production. In other instances, the objectives are competitive. Given the relatively slow rate of adoption of conservation practices, even with cost-sharing, the latter situation is probably common.

Stringent guidelines to control erosion and sedimentation could have adverse economic impacts on farmers, and in turn, pervade the food and fiber production and marketing system. These impacts must be balanced against the positive impacts to be realized from improved water quality. More research is needed, especially on the aggregate impacts of erosion and sediment control, if society is to evaluate the economic trade-offs between public and private costs and benefits and decide upon policy options consistent with society's goals for environmental quality and food production.

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ANIMAL WASTES AS A NON-POINT SOURCE

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I. Non-point source regulations

- A. Term definition
- B. Logic and direction
- C. Zero discharge concept for 1985.

II. Current federal EPA effluent guidelines and limitations for feedlot industry

- A. There shall be no discharge of process wastewater pollutants to navigable waters; i.e.,
  1. Overflow from a pretreatment unit such as a lagoon or oxidation ditch
  2. Rainfall runoff from less than prescribed storms of 24-hour, 10-year (1977) or 24-hour, 25-year (1983) that has come in contact with manure in housing areas or feedlot condition.
- B. A feedlot is defined as an area that does not support vegetative cover, so when livestock are decentralized to allow crop or forage growth, the combined effect of soil and vegetative assimilation and the lower rate of manure deposition could reasonably be expected to preclude any significant pollution problem and thus runoff from such an area does not have to be restricted from flow into surface waters.
- C. Waste pollutants may overflow to navigable waters when rainfall, either chronic or catastrophic, cause an overflow of processed wastewater from a facility designed, constructed, and operated to contain all processed generated wastewater plus the feedlot runoff from a 24-hour, 25 year rainfall event.

III. Point source conditions requiring control to achieve a no discharge or non-point source situation

- A. Stream discharge of pretreatment units
- B. Rainfall runoff from feedlot condition for event less than specified storm
- C. Direct stream contact during land application
- D. Overload of terminal soil-plant receiver
- E. Animal access to streams under certain conditions

IV. Evaluation of non-point source situations

- A. Rainfall data
    - 1. Table I (mg/l)
    - 2. Table II (kg/yr/ha)
- B. Runoff data for pasture land and land used for manure disposal
    - 1. Table III - North Carolina and Wisconsin data
        - a. Similar data from North Carolina and Wisconsin are corroborative, but caution must be exercised against universal applicability.
    - 2. Table IV - elaboration of North Carolina data
        - a. Mass balance analyses for North Carolina study

Site E - 200 sows on 3 acres of dry lot plus waste from 300 confined hogs spread on 5 acres

Parameter	% of total defecated load recovered in stream
BOD	0.69%
TOC	1.66%
TKN	3.0%

- b. Summation of literature mass balance data for feedlot and disposal site runoff indicates generally less than 10% of defecated raw waste load leaves in surface runoff.

- C. Summary of non-point source characteristics
    - 1. Table V
        - a. Note similar area yield rate for crop or unused land used for manure disposal and other lands
- D. Graphical summary of nitrogen and phosphorus contributions by various non-point sources
    - 1. Figure 1 (mg/l)
    - 2. Figure 2 (kg/ha/yr)
        - a. Note similar yield for precipitation, land receiving manure and other land uses, but much higher yields from animal feedlot runoff.

/. Sampling and analytical requirements for non-point source inputs

A. Parameter selection considerations

1. Environmental protection
2. Technical validity
3. Analytical requirements
4. Enforcement demands

B. Parameters suggested for evaluation of non-point source agricultural pollution are:

1. Flow rate
2. pH
3. Temperature
4. Turbidity
5. Suspended sediment
6. Dissolved oxygen
7. BOD
8. P
9. N
10. MPH (coliform)
11. Specific conductance

C. Judgement basis

1. What is actual background quality or judgement basis?
2. Is background load beneficial, of minor local concern, or detrimental?

I. Regulatory approach

A. Relationship to previous or existing laws

1. Would non-point source criteria relate to stream quality classifications, effluent guidelines and limitations, or no discharge regulations?
2. Could developing non-point source criteria result in disapproval of terminal land application systems currently being constructed and operated according to best available technology and EPA effluent guidelines and limitations for the feedlot industry?

3. Will fear of non-point source criteria severely hamstring current progress to implement terminal land application systems for recyclin and elimination of point source discharge?

4. Can all non-point source inputs be controlled, treated, eliminated?

5. Is a uniform national criteria logically and technically sound for control or assessment of non-point source inputs?

6. Allowance for different geoclimagraphic-land use regions: high rainfall-runoff vs. low rainfall-runoff conditions.

B. Are we alluding to a zero tolerance concept?

VII. Control techniques

A. Control procedures are similar for all agricultural chemicals and basicall involve good conservation techniques.

B. Specific control techniques

1. Pretreatment alternatives

2. Application procedures

3. Loading and placement

4. Agronomic considerations

5. Contouring and terracing

6. Sediment basins

7. Water management structures

8. Grassland borders

C. Cost associated with contemporary waste treatment techniques is prohibiti especially when compared with economics of land application and recyclin systems for nitrogen and phosphorus removal and utilization.

VIII. Proposed monitoring and regulatory criteria for animal waste

A. COD-nitrogen monitoring criteria

1. Least non-redundant and most technically feasible analyses that give insight to all associated characteristics

2. Would be particularly applicable for overland flow or diffuse inputs

B. Regulatory approach

1. Define and enforce standards vs. recommended management practices

IX. Difficult questions

A. What length of overland attenuation zone is required between land disposal site and receiving water?

B. What is total mass reduction associated with overland flow treatment vs. dilution?

C. Does all rainfall runoff from prescribed storm carry pollutional load in excess of natural runoff?

D. What accommodation should be made for local conditions and desires of indigenous population?

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TABLE 1—Precipitation Characteristics

Constituent	Concentration under Given Conditions* (mg/l)							
	1963–64 Urban[1]	1963–64 Rural[1]	Couper[3]	Northern Europe[2]	1963–69 Forest[14, 15]	Feth[6]	4 yr Ohio[8]	Joyner[7]
Nitrogen								
NH_4-N	—	—	—	0.06	0.16	0.17–1.5	1.1	—
NO_3-N	—	—	0.14	0.31	0.30	0.56	1.15	—
Inorganic N†	0.7	0.9	—	—	—	—	—	—
Total N	1.27	1.17	—	—	—	—	—	0.73
Phosphorus								
Total PO_4-P	—	—	—	—	0.008	—	0.02	0.04
Hydrolyzable PO_4-P	0.24	0.08	—	—	—	—	—	—
Suspended solids	13	11.7	—	—	—	—	—	—
COD	16	9	—	—	—	—	—	—
Major ions								
Ca	—	—	0.65	—	0.21	—	—	—
Cl	—	—	0.57	—	0.42	—	—	—
Na	—	—	0.56	—	0.12	—	—	—
K	—	—	0.11	—	0.19	—	—	—
Mg	—	—	0.14	—	0.16	—	—	—
SO_4	—	—	2.18	—	3.1	—	—	—
HCO_3					0			

* Data are primarily yearly averages; numbers in headings refer to references.

† Inorganic N = NH_4, NO_2, and NO_3-N.

Originally presented by R. C. Loehr in Characteristics and Comparative Magnitude of Non-point Sources. Journal Water Pollution Control Federation, August 1974.

TABLE 2.—Reported Precipitation Characteristics—Average Nitrogen and Phosphorus

Location	N		P	Reference
	Total* (kg/yr/ha)	NO_3 + NH_4-N (kg/yr/ha)	(kg/yr/ha)	
World mean	6.2 (0.8–7.0)	—	—	11 (pre-1954)
World mean	8.7 (1.8–22.2)	—	—	11 (1905)
Europe and U. S.	—	0.8–2.1	—	11 (pre-1952)
Temperate zone	—	6.8	—	11 (1938)
Humid temperature zone	5.6	—	—	11 (1960)
New York	10.0	—	—	11 (pre-1948)
United Kingdom				
Upland	8.2	—	0.27	12
Northern	8.7–19	—	0.2–1.0	12
Netherlands				
Rural	8.5	—	—	13
Industrial	16–100	—	—	13
Canada				
Hamilton, Ont.	—	6.0	—	14 (1948)
Ottawa	7.7 (4.8–12.9)	—	—	14 (1924–25)
Ceylon	—	12.9	—	14 (1941)
Western Australia	0.5–3.2	—	—	3
Scotland	8.2	—	0.45–0.7	10 (1962–63)
Ithaca, N. Y.	—	7.4	0.05	15
Aurora, N. Y.	—	7.6	0.06	15
Geneva, N. Y.	—	8.3	0.05	15
Hubbard Brook, N. H.	—	5.8	0.10	16
Cincinnati, Ohio†	9.6	5.2	0.6	9

* Data in parentheses indicate range of data.

† Average U. S. rainfall of 30 in. (76 cm)/yr assumed.

Originally presented by R. C. Loehr in Characteristics and Comparative Magnitude of Non-point Sources. Journal Water Pollution Control Federation, August 1974.

TABLE 3—Characteristics of Runoff from Pasture Land and Land Used for Manure Disposal

Location and Conditions	Constituent						Remarks	Reference
	BOD	COD	TOC	NO_3-N	Total N	Total P		
North Carolina (g/day/ha)	30	—	63	—	7.6	2.8	Mixed grains and orchard, swine waste spread	40
	17	—	124	1.8	10.4	0.6	Pasture, corn, orchard, swine waste spread	
	35	—	97	1.7	7.7	3.5	250-hog drylot, row crops, wood, grassland	
	94	750	150	4.0	38	25	Pasture for 50-100 dairy cows, plus corn	
	3,450	10,700	3,750	46.5	400	130	Pasture for 160 cows on 15 acres	
	26	320	72	8	10	1.8	Poultry waste spread on 5 acres 3 times/yr	
	1,850	4,350	2,250	14	435	—	22 tons of poultry waste spread on 4 acres once	
	46	720	150	—	5.8	1.8	35 beef cows on 15 acres of pasture	
Wisconsin (kg/yr/ha)								
Manure not spread	—	—	—	—	4.4 (3.6–5.5)	1.3 (1.2–1.5)	3-yr average—1967-69, dairy cattle manure spread at the rate of 15 ton/acre	41
Manure applied*								
Winter	—	—	—	—	12.7 (3.0–27)	2.9 (1.0–5.8)		
Spring	—	—	—	—	3.8 (3.0–5.2)	0.8 (0.7–1.0)		

* High values due to a thaw and a 0.75-in. rain immediately after spreading manure in winter; manure spread in the spring was incorporated into the soil after spreading.

Note: Acre × 0.405 = ha; in. × 2.54 = cm.

Originally presented by R. C. Loehr in Characteristics and Comparative Magnitude of Non-point Sources. Journal Water Pollution Control Federation, August 1974.

TABLE 4—Site Data and Yearly Mean Stream Quality from Agricultural Land Runoff

Variable	Value at Given Site					
	F	E	K	P	X	Z
Number of animals*	0†	50‡	20§	42#	38‖	21**
Watershed area, acres	75	35	50	65	5	25
Soil types	Sandy loams	Sandy and fine sandy loams	Loamy sands	Fine sandy loams	Sandy loams	Sandy loams
Slopes, %	0–25	0–15	0–6	2–10	2–10	0–25
Flow, cfs	0.109	0.040	0.047	0.055	0.006	0.020
gpd/acre	940	740	590	550	780	520
gpd/animal	—	510	1,540	850	100	620
Study period	12/68–8/69	12/68–8/69	4/69–8/69	6/69–4/70	2/70–4/70	11/69–4/70
Number of samples	148	176	100	108	27	78
FC, 10^3 col/100 ml	10.0	190	370	9.6	0.2	30.7
10^9 col/day/acre	0.33	5.12	8.2	0.19	0.01	0.58
10^9 col/day/animal	—	3.58	20.4	0.30	0	0.69
BOD_5, mg/l	2.0	4.7	6.4	5.2	265	9.8
lb/day/acre	0.015	0.028	0.031	0.023	1.66	0.041
lb/day/animal	—	0.020	0.079	0.036	0.218	0.049
TOC, mg/l	14.6	9.6	17.6	14.2	322	32.5
lb/day/acre	0.111	0.057	0.087	0.063	2.02	0.136
lb/day/animal	—	0.040	0.216	0.097	0.266	0.162
N, mg/l	1.4	3.7	1.7	3.5	62	2.6
lb/day/acre	0.011	0.022	0.008	0.015	0.389	0.011
lb/day/animal	—	0.015	0.021	0.024	0.051	0.012
PO_4, mg/l	0.2	1.2	1.9	1.2	—	1.1
lb/day/acre	0.002	0.007	0.009	0.005	—	0.005
lb/day/animal	—	0.005	0.023	0.008	—	0.006

* 1,000 lb live weight basis.

† Devoid of domestic animal wastes.

‡ 200 sows on 3 acres of dry lots plus wastes from 300 confined hogs spread on 5 acres.

§ 200 hogs on 6 acres of dry lots.

# 60 tons of poultry wastes plus shavings spread on 15 acres, yearly.

‖ 22 tons of poultry wastes spread on 4 acres, once.

** 35 beef animals on 15 acres of pasture.

Note: Acres × 0.405 = ha; gal × 3.785 = l; lb × 0.454 = kg.

Originally presented by J. W. D. Robbins, D. H. Howells, and G. J. Kriz, in Stream Pollution from Animal Production Units. Journal Water Pollution Control Federation, August 1972.

TABLE 5..—Summary of Non-Point Source Characteristics*

Source	Concentration (mg/l)					Area Yield Rate (kg/yr/ha)					Surface Area of Interest
	COD	BOD	NO$_3$-N	Total N	Total P	COD	BOD	NO$_3$-N	Total N	Total P	
Precipitation	9-16	12-13	0.14-1.1	1.2-1.3	0.02-0.04	124	—	1.5-4.1	5.6-10	0.05-0.06	Total land area
Forested land	—	—	0.1 -1.3	0.3-1.8	0.01-0.11	—	—	0.7-8.8	3-13	0.03-0.9	Forest area
Range land	—	—	—	—	—	—	—	0.7	—	0.08	Range land
Agricultural crop land	80	7	0.4	9	0.02-1.7	—	—	—	0.1-13	0.06-2.9	Active crop land
Land receiving manure	—	—	—	—	—	—	—	—	4-13	0.8 -2.9	Crop or unused land used for manure disposal
Irrigation tile drainage, western U. S.											
Surface flow	—	—	0.4-1.5	0.6-2.2	0.2 -0.4	—	—	—	3-27	1.0 -4.4	Irrigated western soils
Subsurface drainage	—	—	1.8 -19	2.1-19	0.1 -0.3	—	—	83	42-186	3-10	Irrigated western soils
Crop land tile drainage	—	—	—	10-25	0.02-0.7	—	—	—	0.3-13	0.01-0.3	Active crop land requiring drainage
Urban land drainage	85-110	12-160	—	3	0.2 -1.1	220-310	30-50	—	7-9	1.1-5.6	Urban land areas
Seepage from stacked manure	25,900-31,500	10,300-13,800	—	1,800-2,350	190-280	—	—	—	3	—	Manure holding area
Feedlot runoff	3,100-41,000	1,000-11,000	10-23	920-2,100	290-360	7,200	1,560	—	100-1,600	10-620	Confined, unenclosed animal holding areas

* Data do not reflect the extreme ranges caused by improper waste management or extreme storm conditions; the data represent the range of average values reported in previous tables.

Originally presented by R. C. Loehr in Characteristics and Comparative Magnitude of Non-point Sources. Journal Water Pollution Control Federation, August 1974.

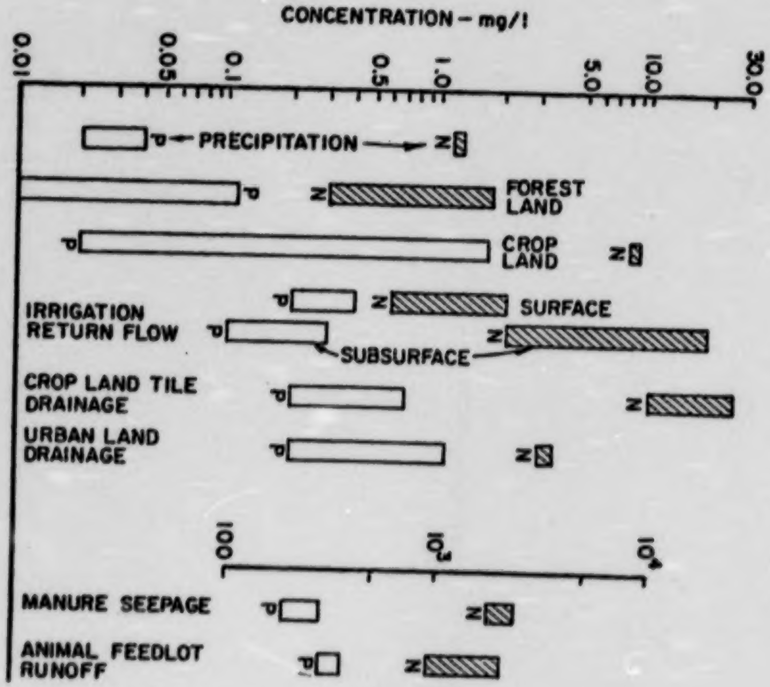

FIGURE 1.—Comparison of non-point sources, giving range of total N and P concentrations.

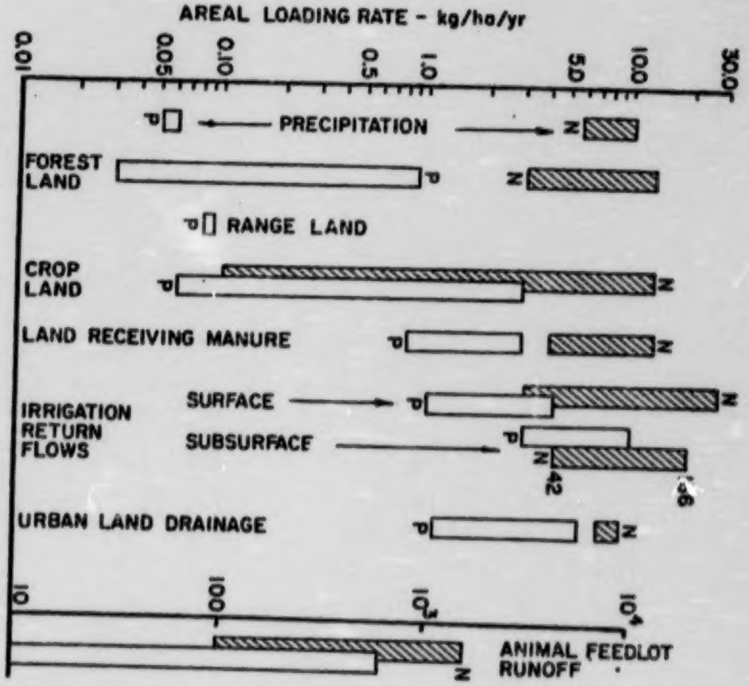

FIGURE 2.—Contributions of total N and P by various non-point sources.

Originally presented by R. C. Loehr in Characteristics and Comparative Magnitude of Non-point Sources. Journal Water Pollution Control Federation, August 1974.

PLANT NUTRIENTS IN NON-POINT SOURCES OF WATER POLLUTION

Samuel R. Aldrich[1]

(Agricultural Non-Point Source Water Pollution Control
Workshop. Washington, D. C. September 16-17, 1974)

I. STATUS AND TRENDS

Nearly all concern centers on nitrogen and phosphorus.

A. Nitrogen

1. Nitrate in many Corn Belt streams exceeds the present USPHS standard (10 mg/l NO_3^--N) for a few weeks in most years.

2. Annual average NO_3^- concentrations in streams in intensively farmed areas typically increased about 50 percent from 1956 to 1972; some increased only 25 percent, other 100 percent. NO_3^- in the Mississippi River above the confluence with the

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Ohio River increased 50 percent from 1956 to 1973 (from 1 up to 2 mg/l NO-N).

3. NO_3 concentration in small streams in the northern half of the U.S. tends to be highest in April through June (but to be associated quite directly with volume of flow at all times) and lowest in July to September.

B. Phosphorus

1. The available phosphorus in most surface waters in important agricultural areas is adequate to support nuisance algal blooms if all other factors are favorable (.01 mg/l PO_4^- - P).

2. Neither total nor soluble phosphorus is increasing very dramatically except locally where there are major point-source inputs.

3. There is no strong seasonal trend in filtered phosphates in medium to large rivers, but land runoff would be highest in the fall and early spring when the ground is frozen and residues have decomposed.

II. SOURCES AND MECHANISMS

A. Nitrogen

1. Sources

a. High inherent organic matter content in the soil. Release is accelerated by drainage and tillage.

b. Over-application of nitrogen fertilizer. Illinois, Missouri and Wisconsin researchers found little accumulation of NO_3^- in the soil profile with 100 to 150 lb. annual applications. (Application in a corn-soybean system is usually less than 100.)

c. Large applications of animal manure or sludge. Suggested maximum of 20 to 30 tons annually of large animal manure (½ for poultry manure); 250 lb. per acre of NH_4^+-N in sludge the first year, 200 thereafter.

d. Nitrogen released from leguminous sod.

e. Rainfall (5-6 lbs. generally, but higher locally).

f. Free living nitrogen fixers.

g. Colorado researchers reported that large amounts of Ammonia were absorbed by surface waters in the vicinity of large feedlots.

2. Mechanisms

a. Nitrogen reaches surface water by moving through the soil to tile lines or in base flow. The time scale is not established.

b. Most fertilizer nitrogen enters the biological system in the year of application. How to reconcile with downward moving bulge of NO_3^-?

c. Nitrogen most vulnerable to moving is that in NO_3^- form after crop uptake ceases in the fall. Relates to hydrologic cycle.

B. Phosphorus

1. Sources

a. Sediment resulting from erosion. Soil and solution phosphorus equilibrates, hence sediment may increase or decrease soluble content.

b. Soluble organic compounds from the decay of plant residues especially when soil is frozen.

c. Soluble phosphates from animal manures especially on sloping, frozen fields.

d. Fertilizer: only 1 percent following 5 inches of simulated rainfall on a steep slope (Purdue).

e. Rainfall. Amounts not well established.

2. Mechanisms

a. Phosphorus moves over the soil surface.

b. Retention capacity of agricultural soils adequate to hold all practical rates of application. (Some compounds "leak through"?) (Michigan)

c. Retention capacity can be exceeded by heavy, repeated animal manure and sludge applications. (Retention capacity regenerates within a few months.)

III. ENVIRONMENTAL SIGNIFICANCE

A. Nitrate Concentration in Water

1. Human health effects.

    a. Fetus. Possible effects unknown. None established.

    b. Infants 0 to 6 months, especially with digestive upsets. Most vulnerable because of high gastric pH. Last death was in 1949. U.S.P.H.S. Standard appears to have a sizeable built-in safety factor, but some scientists speculate that there are hidden, delayed effects. Infants can be protected by alternate water sources and possibly by assuring adequate Vitamin C intake.

c. Adults. No known problems within realistic range, but a sensitive element in the population has been postulated.

2. Livestock

a. Monogastric animals (swine, poultry). High tolerance.

b. Ruminant animals (cattle, sheep). Less tolerance than monograstric, but literature is very confusing. No realistic problem is likely to surface waters. Well water even up to 10 times USPHS standard has not caused identifiable problems. Nitrates in corn stalks and oats have caused deaths.

3. Aquatic life. Very sensitive to NH_4^+. No toxicity standards for NO_3^-. Doubtful that N is the controlling factor in eutrophication and excessive algal growth.

IV. CONTROL OR AMELIORATION

The 1977 goal of "best practicable control technology currently available," the 1983 goal of "best available technology economically achievable," and the 1985 goal of "no discharge of pollutants" do not apply to non-point sources, including agricultural runoff!

The 1983 "interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on water "whenever attainable" does apply to non-point sources.

A. Nitrates

1. Match rate of fertilizer N to efficient crop utilization. Raise crop yield potential with good supporting practices.

2. No fall or early spring application on sands.

3. Discourage fall application generally (?); apply late if at all and in NH_4^+ form or compounds that convert to NH_4^+.

4. Nitrification inhibitors? Possibly for fall application generally and early spring on sandy soils. Of doubtful value and may be counter-productive for many situations because it may increase the amount of NO_3^- in the soil after crop growth ceases in the fall.

5. Minimize application of fertilizer and animal manure on frozen, sloping fields near streams or lakes.

6. Avoid over-application of manure or sludge.

7. Plant grass cover crops in the fall to absorb NO_3^- (?).

8. Shifting dependence from fertilizer to organic sources of N of doubtful value. (See item 4 above.)

B. Phosphorus

1. Control soil erosion.

2. Avoid building excessive phosphorus soil test levels.

3. Avoid application of fertilizer and animal manure on frozen, sloping fields near streams, lakes, and reservoirs.

4. Prevent direct runoff from feedlots.

5. Do not site large concentrations of livestock adjacent to surface water.

6. Avoid exceeding the retention capacity of the soil by applications of manure or sludge.

7. The impact of no-plow and trash mulch systems is uncertain. Sediment yield will be less, but phosphorus level of sediment will be higher. Runoff of soluble organic phosphates will be higher.

8. Large, infrequent broadcast applications plowed under or disked in would minimize runoff.

C. The concept of amount of plant nutrients from non-point sources per unit of crop produced should be introduced into the decision-making process.

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TECHNOLOGY TRANSFER

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I would like to begin this evening on a rather lofty plane by quoting Alfred North Whitehead. In his Lowell lecture series of 1925, Whitehead devoted one lecture to "The Nineteenth Century," in which he stated:

> The greatest invention of the 19th century was the invention of the method of invention. We must concentrate on the method itself; that is the real novelty, which has broken up the foundations of the old civilization. Science, conceived not so much in its principles as in its results, is an obvious storehouse of ideas for utilization. But, it is a great mistake to think that the bare scientific idea is the required invention, so that it has only to be picked up and used. An intense period of imaginative design lies between. It is a process of disciplined attack upon one difficulty after another.

Almost a half century later, we are still in that learning process. This spring one of the most sought-after documents in town was a National Academy of Engineering booklet entitled Technology Transfer and Utilization: Recommendations for Redirecting the Emphasis and Correcting the Imbalance. The popularity of this publication is a clear indication of the lively and continuing interest in the topic of technology transfer on the part of industrial leaders, academics, and government officials at all levels. In its assessment of where we stand, the National Academy report had this to say:

> The Federal government should not simply tell users about promising technologies; it should concentrate instead on actually transforming technical information into ultimate uses that fulfill public or private socio-economic needs. This will likely require $1 billion annually, not the $43 million currently being spent.

Another indication of the continuing interest in technology transfer is the formation of two Federal agency committees within the past several months. In April, the Federal Council on Science and Technology chartered an Inter-agency ad hoc Committee on Domestic Technology Transfer, which seeks to improve the process for transferring technology from the Federal to the State and local levels. Last month the General Accounting Office and the Office of Management and Budget convened an Inter-agency Committee on Executive/Policy Management Assistance. This committee, which I chair, is attempting to develop options and Federal strategies for strengthening executive management capability of State and local governments. These two committees are currently assessing where we stand vis a vis technology transfer, in the hope of pinpointing successful approaches and learning from less successful endeavors. One of the most tantalizing aspects of this field is that there are so many paths to success, yet so many more dead-end roads.

This evening I'd like to survey briefly five of the strategies which people in this field have pursued in order to facilitate the process of technology transfer.

1. Increase technical capability of manpower in State and local governments. The Intergovernmental Personnel Act (or IPA) program aims to improve State and local core management, or "general government," capabilities through personnel management improvements, employee training and development, and temporary exchanges of expert personnel. This personnel exchange represents a high degree of cooperation between levels of government, with over 1500 participants in the program's three years of existence.

   The 1973 Comprehensive Employment and Training Act has resulted in a consolidation of manpower programs, and is providing that most of the FY 1975 manpower appropriation be distributed to State and local governments. State and local governments can then determine the best allocation of funds for manpower training, public service employment, and other services.

2. Disseminate technological information to State and local governments. In the past, Federal agencies have tended to depend upon the passive techniques of collecting, indexing, storing, and disseminating scientific and technical information upon the specific request of a potential user. However, experience seems to indicate that an information system becomes more useful as it becomes more needs-specific and/or functions as a broker instead of a passive clearinghouse. Several mission agencies have undertaken more active approaches -- the USDA, the Department of Transportation, and the Law Enforcement Assistance Administration, to name a few.

   The Department of Defense Laboratory Consortium, whose activities are coordinated through a Federal laboratory liaison officer in the NSF Office of Intergovernmental Science and Research Utilization, is a brokerage network consisting of nearly 40 Federal laboratories which have undertaken over 100 technology transfer projects to date, with a reimbursed funding level in excess of $10 million.

   The Department of Transportation and the National Science Foundation have recently funded the Urban Consortium for Technology Initiatives in association with Public Technology, Incorporated. PTI, a Washington-based non-profit organization with 100 State and local dues-paying subscribers, seeks to provide technical information and products to State and local governments in a form which is amenable to immediate application. The Urban Consortium network, which links the 26 largest U.S. cities and six urban counties -- representing 38 million Americans and a total budget of $21 billion -- is a cooperative technology transfer and utilization effort through which the cities can identify common problems, seek the appropriate technology, exchange information and work with the Federal or private R&D establishments to pursue relevant research.

3. Increase State and Local participation in Federal science and technology policymaking. This is an area where much of the initiative has been - indeed, must be -- taken by the State and local leaders themselves. My committee and the Federal Council for Science and Technology Committee place a high priority on State and local inputs, but this is not enough. Greater opportunities must be provided for State and local membership on Federal policymaking committees. Furthermore, market aggregation through various networks is bound to influence Federal policymakers more than isolated requests, and more of this is needed. Active groups such as the Council of State Governments and the National League of Cities serve as an important link between their constituents and Federal policymakers. In addition, individual State

and local governments must actively seek a larger role, in much the same vein as they worked to obtain general revenue-sharing. The recently-enacted energy bill in California, with its specific provision that the State Energy Resources Conservation and Development Commission should attempt to influence Federal energy R&D priorities, may be a sign that States plan to have a greater say in matters of vital importance to them.

4. Technical support to State and local governments from institutions with science and technology resources.
Almost every Federal R&D agency has funded this kind of activity, so let me mention just a few examples. The HUD-sponsored Urban Observatory program offers university expertise to approximately a dozen cities. NASA's "TATs" (Technology Application Teams), consisting of professional transfer agents with a variety of disciplinary backgrounds, are based at research institutes around the country. The NSF-supported Four Cities program in California and the Tacoma, Washington, Totem I program are providing technical aerospace personnel to local governmental units. The R&D Incentives Office at NSF is sponsoring an Urban Technology System, a three-year, $4.2 million initiative to foster innovative ways to accelerate the transfer of science and technology to practical applications: 27 Technology Agents and their back-up technical organizations, are serving 27 cities in the 50,000 - 500,000 population class.

5. Support or conduct research and/or demonstration projects.
Again, this is a popular option which many Federal agencies have followed. The Department of Housing and Urban Development, for example, has recently launched a $2.5 million R&D project affecting over 60 cities in nine states, with a primary goal of finding and testing management tools and techniques which can be used by local government policymakers.

The National Institute of Law Enforcement and Criminal Justice, which is the research center of the Law Enforcement Assistance Administration, supports research, evaluation, and technology transfer projects. An interesting technology transfer technique is the Exemplary Projects program, through which LEAA spotlights unusually promising practices and strategies in the field of criminal justice. The Institute helps selected communities to reproduce successful programs by providing handbooks and guidelines, specially tailored training materials and courses, financial assistance, and evaluation.

Since it is your particular interest in environmental activities, especially as they relate to Public Law 92-500, that brings you to Washington, I would like to single out three environmentally-related technology transfer efforts for your consideration.

First, I would mention the role of the International City Management Association in providing city managers with usable information on current, successful methods of solid waste management. The ICMA solid waste management project, under contract with the Environmental Protection Agency's Office of Solid Waste Management Programs, came in response to EPA's concern that its technological products were not being used at the local level. The ICMA response began with regional seminars, with 100 participants becoming charter members of the Solid Waste Management Network. Through this network the ICMA has disseminated products such as a solid waste management decision-making guide, special technical information packages, management information and inquiry services, and other relevant documentation. In addition, professional transfer teams offer a manager-to-manager exchange for the purpose of information dissemination in subjects not addressed by the EPA technical assistance staff. Thus, the EPA technical assistance staff provide technological expertise and the professional transfer teams offer practical managerial advice and experience to city managers facing solid waste disposal issues,

A second example is found at Lake Tahoe. Not only is the Lake Tahoe area an ecosystem where the quality of the land directly impacts that of the lake, but it also exemplifies the thorny intergovernmental dilemmas which confront officials who must decide how best to preserve the fragile ecology of Lake Tahoe, amid rapid development. The Tahoe Regional Planning Compact, ratified by Congress in 1969, provided a strong basis for coordination of the governmental activities of 15 Federal agencies, 20 State agencies, and a large number of local and intergovernmental bodies, through its creation of the Tahoe Regional Planning Agency. This Agency is mandated to guarantee the Basin's orderly development through preparation and enforcement of a regional plan. While developing the plan, the Agency discovered an alarming lack of pertinent qualitative and quantitative information, despite the considerable body of research being undertaken by various groups. To address this need, the Lake Tahoe Area Research Coordination Board, which is sponsored by my office, is identifying research needs, encouraging research applicable to those needs, and developing an information system to make the results readily available. The success potential for this project is significantly enhanced for several reasons. It exists in response to a specific need articulated by the user community. The Research Coordination Board is easily accessible to the research and user communities which it servies. During its first year it has sought new contacts and the development of research needs agendas, and its inventories of research, seminars, and newsletters have contributed to the Board's effectiveness and visibility. These factors, as well as the group's specific environmental focus, make it likely that the Research Coordination Board will remain an integral part of the research and planning process in the Lake Tahoe Basin.

I would like to conclude this evening by discussing a way in which the Cooperative Extension Service might forge new links between agriculture and other scientific disciplines, while at the same time strengthening its own technology transfer capability.

In September 1972, the Environmental Protection Agency sponsored a National Environmental Information Symposium, where 1700 producers and users of environmental information convened to explore how more efficient means of dissemination and utilization of environmental information could be achieved. In response to the suggestion at that meeting that the Cooperative Extension Service be tested as a delievery mechanism for environmental information, we at NSF hosted a meeting of EPA, USDA, and Extension Service representatives, where it was agreed that feasibility studies should be undertaken. Colorado State University, Oklahoma State University, and the University of Tennessee were awarded small planning grants to survey environmental problems in their respective states and to develop pilot programs for an Environmental Extension System.

Each of the proposed pilot programs has a different mode for reaching its own target groups. Tennessee will try a joint operation of two independent agencies -- the Agricultural Extension Service and the Institute for Public Service -- to locate environmental information and then re-package it appropriately to make it useful to towns and small cities in a four-county region in the southeastern part of the State. Oklahoma, by linking its Cooperative Extension Service with strong on-campus backup and a network of advisory committees, will attempt to address a limited number of statewide issues. The Oklahoma project will engage in training programs for present County Agents to increase their capability to provide specific environmental advice on topics which are given priority by the groups they serve. The traditional County

Agent approach, supplemented by on-site Environmental Technology Transfer Agents and campus-based Environmental Specialists, is the strategy to be employed in Colorado to deal with a wide range of problems faced by three different communities in environmentally distinct regions of the State.

Several factors point to the probable success of an Environmental Extension System based on the Cooperative Extension Service, provided that adequate funds are allocated to the project. Over sixty years' experience in agricultural technology transfer has resulted in credibility and respect for your well-established delivery system. As professional Extension workers, your contacts with both the academic world and the user communities are already well defined. The Environmental Protection Agency Office of Technology Transfer has indicated its commitment to provide every possible kind of technical assistance to help ensure the success of this pilot venture. This commitment is particularly important to make sure that Extension workers have access to and understanding of R&D results from government and industrial laboratories. The expertise and contacts available through the staff of NSF's Division of Advanced Environmental Research and Technology will complement that of the EPA.

I hope that the time is right for the Cooperative Extension Service, based on its enviable success in the past, to accept a new challenge and to contribute its unique capabilities to help this Nation understand and protect its environmental heritage. I hope that you also will share my enthusiasm for this opportunity to write a new chapter in the story of technology transfer.

Subject Matter Report

Water Erosion and Sedimentation

Discussion Leader: Robert D. Walker
Recorder: Berlie L. Schmidt

Conservation tillage for controlling soil erosion was considered an excellent soil erosion control practice by the thirty participants in the workshop session. There are many types of conservation tillage ranging from plow - plant systems to no-till. The no-till system is generally the most effective soil erosion control system but is dependent on chemicals for weed and insect control and requires the highest degree of management. No-till systems seem best adapted to the South and South-east and with drained soil. The chisel plow or disk system that leaves some crop residue on the surface is used in the Great Plains and Corn Belt to control wind and water erosion, but may result in reduced yields or poorly drained soil. Regardless of the system selected, the farmer is making a compromise in his farming system to best meet his needs. The system is re-evaluated each year.

Conservation tillage alone will not control all field soil erosion. It should be supplemented with other practices such as contouring, grass waterways, structures, terraces, etc. depending on the need.

Most states that have developed soil erosion regulations have adopted the soil loss tolerance (T values) as their standards for permissable soil loss. T values are based on the amount of soil loss that scientists believe should not be exceeded if we expect to maintain production over a long period. The group felt that we need further refinement through research of the T values. In addition, we need more information on how a soil erosion program will affect water quality.

Discussion was centered primarily around controlling soil erosion on agricultural land, but soil erosion from urban development, highway construction, stream banks and gullies was also recognized as adding silt to streams and lakes. A water quality program must consider all sources of soil erosion.

Section 305(b)of PL 92-500 places responsibility on states to develop guidelines and standards. The Cooperative Extension Service can assist in developing guidelines by supplying their own expertise, by identifying local leadership, and by taking the proposed guidelines out in the state for public input. The program should be conducted in such a way that the Extension Service and Land Grant University is not identified with establishing regulations or they may lose much of their effectiveness in carrying out educational programs.

Development of guidelines at the state and local level will be required to solve specific local soil erosion problems. For example, soil erosion on irrigated lands, low organic matter soils, deep loess areas, forest areas, etc.

We have the knowledge to develop soil conservation programs to control much of the man made soil erosion but, because of social and economical reasons, many farmers have not adopted conservation programs. We need additional information on how to get farmers to accept sound soil erosion control programs.

Several major problem areas were not covered in the conference and should be considered for a future conference. These include soil erosion on irrigated land, salt problems as related to irrigation, soil erosion on federal land, and soil erosion on forest land.

Because there were no participants that selected the Workshop on Wind Erosion and Sedimentation, this workshop was combined with the workshop on Water Erosion and Sedimentation. The consensus of the discussion leader and the resource person (Dr. Woodruff) was that, while wind erosion is a concern regarding air quality, there is little concern about the contribution of wind derived sediment to water quality degradation.

SUBJECT MATTER REPORT on ANIMAL WASTE[1]

Probably in no area has the intensity of Extension involvement in pollution control been greater than in the field of livestock waste management. Most of us have by now grown accustomed to the fragile balances we sometimes have to maintain in dealing with both agricultural producers and regulatory agencies while maintaining our posture as educators. We hope the wisdom this experience has provided can help guide Extension programs in agricultural non-point source pollution control in the days ahead.

The discussion session on animal waste as a non-point source of water pollution was attended by some 41 persons. The main thrust of our discussion was to identify areas of agreement to assist EPA in establishing regulatory programs and to guide Extension educational programs that will begin to unfold. In a lively two-hour discussion session, we addressed ten questions, with responses summarized below:

Question 1: What is the limit to land disposal rates for animals manures such that non-point source pollution problems are avoided?

Answer: The acceptable loading rate all depends upon waste characteristics as well as climatic and economic factors. Application rates for disposal vs. utilization of animal wastes are widely different, ranging (on a 40% moisture basis) from as high as 150 to 300 tons per acre per year for disposal with minimal crop damage to as low as 10 tons per acre per year for maximum utilization of manure fertilization value. Surface and ground water qualities are not impaired by application rates consistent with maximum economic utilization of manure, according to most research.

Question 2: Will stream watering sites for cattle be affected by non-point source regulations, guidelines, or standards?

Answer: EPA should not define pollution potential in terms of animal units, expecially for non-point sources. Each farm or feeding operation should be inspected individually; this is far better than any national guideline.

Question 3: What would people look for or measure during on-site inspection of a livestock operation?

Answer: Multi-parameter equations, which relate factors such as number of animal units, type of facility, distance to stream, waste management practices, etc., to pollution potential, are helpful and have been used sucessfully by some state agencies. Sampling to prove the existence or non-existence of a pollution problem is difficult and expensive. The method of assessment may not differ much from procedures already used for identifying point-source pollution problems. Extension can have maximum impact in training regulatory officials in the agricultural community as to just what constitutes a real vs. an imagined pollution problem.

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[1] Extension - EPA Workshop on Non-Point Source Pollution, Washington, D.C., September 16 - 17, 1974; Ted L. Willrich, Oregon State University, discussion leader; John M. Sweeten, Texas A&M University, reporter.

Question 4: Have the State Extension Services conducted statewide programs for producers in the area of animal waste management and pollution abatement?

Answer: This has apparently been done in most states, whether through commodity channels, Extension meetings, publications, mass media, or whatever. In this connection, however, specialists felt that the credibility of Extension programs are impaired when specialists are unable to answer positively that animal waste management systems recommended today will be acceptable with respect to forthcoming regulations on non-point sources or odors. This would especially be true at the present time when non-point source regulations are expected and the current animal-unit definition of a point source may be lowered as a result of litigation. Not all states have experienced the credibility problem, however.

Amid changing regulations, the surest bet is to expound basic measures that are known to be helpful both in controlling pollution AND in streamlining the onerous task of manure management. Examples of such basic steps include diversion of outside drainage, providing adequate manure storage capacity, collecting obviously polluted runoff from corral areas, and proper land disposal of manure to recycle plant nutrients.

Question 5: Are present practices that ultimately involve land disposal adequate from the standpoint of non-point source pollution control?

Answer: Research at various locations has shown that runoff from manure-applied land did not contain appreciably higher pollutant loadings than runoff from natural or "background" areas.

Some participants suggested that agencies and/or Extension develop guidelines for land disposal that would assure compliance and avoid the almost impossible task of monitoring every agricultural watershed that contains livestock. From recent and ongoing research it may be possible to define these loading rates. Other participant took the view that we could not wait for research to define these loading levels and prediction models, but rather that we need to work now with agencies, farmers, and environmental interest groups.

Because of the obvious infeasibility of monitoring every watershed, participants favored design ("good practice") standards versus performance standards for determining acceptability of livestock operations. If an operation conforms to "good practice", the producer should be considered in compliance.

Question 6: Can we define good agricultural practices in terms of best practical and best available technologies?

Answer: EPA officials feel that someone in agriculture needs to define or to certify just what constitutes "good practice". Extension's role in this might be a very controversial one. However, the group concluded that Extension should provide general recommendations to agencies as to what constitutes "good practice" within a given industry segment on a state and local basis only.

Question 7: What considerations need to be a part of non-point source guidelines?

Answer: One approach would be to handle all waste water and any runoff from corrals and manure disposal areas as if it were polluted; in other words, requiring zero discharge automatically. On the other hand, some argued that many practices that would otherwise appear pollutional are proving otherwise by careful research. A middle of the road approach might be to apply manures and wastewaters to land at rates that make maximum economic use of the nutrients as fertilizer. Otherwise, discussion of this question was inconclusive and incomplete.

Question 8: What constraints are imposed by regulatory manpower levels in trying to establish non-point source requirements?

Answer: EPA does not want (and from a practical standpoint is unable) to establish a program of issuing permits to every livestock operation in the U.S. One approach to building a state regulatory staff to handle increasing demands entails using fees collected from permittees (on a per head basis) to hire additional manpower.

When an agency's reach exceeds its grasp, its credibility and the level of compliance can suffer. For example, one state has experienced a low level of registration (about 10%) with a four-year old regulation which swine producers feel is unjustified and discriminatory.

Question 9: What should EPA non-point source criteria for livestock production operations be?

Answer: Most participants felt we should be able to categorically exclude certain activities such as proper land disposal based on research data presented to date. One EPA official felt that we may already be near or at the point of zero discharge from a practical standpoint when we exercise prudent land disposal. The agency should rely on stream monitoring networks and state inventories of sources to identify potentially serious or real non-point pollution sources. Extension specialists can then work with these producers upon request to solve their problems.

The National Commission on Water Quality, created pursuant to Section 515 of Public Law 92-500, should be given the benefit of Extension expertise and experience in meeting its obligation to define for Congress needed legislation. This is especially true as controversy grows over the zero discharge concept. (See attached resolution.)

Question 10: In reporting to Congress next October concerning state and federal assessments of non-point source pollution problems, does EPA plan at this point to ask for authority to directly regulate agricultural non-point sources?

Answer: No. EPA has its hands full already in issuing permits to point sources. And EPA does not feel it has the answer yet to establish sound regulations for agricultural non-point sources.

RESOLUTION

The discussion group on animal wastes, assembled at the Extension Service - EPA Workshop on Non-Point Source Water Pollution Control, which convened September 16 & 17, 1974 in Washington, D.C., unanimously adopted the following resolution:[2/]

WHEREAS THE HYPOTHESIS OF ZERO DISCHARGE HAS BEEN PROMULGATED; AND, WHEREAS THIS HYPOTHESIS HAS BEEN QUESTIONED FROM A TECHNICAL AND A PRACTICAL POSITION OF ATTAINMENT;

THEREFORE BE IT RESOLVED THAT THE NATIONAL COMMISSION ON WATER QUALITY BE REQUESTED TO DETERMINE THE FEASIBILITY AND SOCIAL IMPLICATION OF SUCH A GOAL THROUGH CONSULTATION WITH APPROPRIATE REPRESENTATIVES OF THE DEPARTMENT OF AGRICULTURE AND OF LAND GRANT COLLEGES AND UNIVERSITIES.

[2/] This resolution was drafted by Vic Osterli, Cooperative Extension Service, University of California, and Ted L. Willrich, Cooperative Extension Service, Oregon State University.

SUBJECT MATTER REPORT - PESTICIDES

Agricultural Nonpoint Source Water Pollution Control Workshop
8:15-10:15 A.M., September 17, 1974

Mayflower Hotel, Washington, D.C.

Dr. Gayle L. Worf — Discussion Leader
Dr. Burton R. Evans — Recorder

Pesticide sources in water are acknowledged to come from accidental or careless contamination; application procedures--including spray drift-runoff; seepage or infiltration; and contamination resulting from erosion of soil particulates to which chemicals are attached.

Regulatory approaches toward pesticide contamination control are recognized as an important element of environmental protection. FEPCA (PL 92-516) provides a framework for considerable control mechanisms, and as such, should supplement objectives and procedures of PL 92-500. For instance, applicators using restricted use chemicals after October, 1976, must be certified through a cooperative Federal-State arrangement. However, users of "general use" pesticides will not be so regulated. Furthermore, the residual pattern, solubility, fish and wildlife toxicity and similar characteristics must be determined for all registered pesticides. This information should be helpful in developing the most appropriate means of selecting, applying and handling pesticides.

The law also directs procedures, which when properly followed and/or enforced, will essentially eliminate water pollution that presently results from chemical containers and leftover or residual materials entering public waters accidentally or carelessly. Examples of this include old pesticide barrels used as floating devices and equipment rinse water flushed into water directly or in waterways. There are some technical problems to be resolved as yet, and there will be continued educational needs to encourage applicators to follow the intent as well as the letter of the law. Development of a deposit charge system for reusable containers; triple rinse procedures; destruction and proper disposal of non-recycling containers were suggested as specific possibilities.

Monitoring programs are underway that help identify present and potential contamination problems. Methodology of monitoring remains a technical difficulty. What level of contamination by pesticides can be tolerated? What levels of standard and monitoring procedures will be established? Should these deal with the water--or both? Will the concept of "zero tolerance" be applied to chemicals in water?

There is evidence that urban areas are a source of much higher pesticide contamination per unit area than corresponding rural areas. Both technical, legislative and educational needs may be challenged by this fact.

Concern over drift contamination resulting from aerial application was discussed. Other application procedures cause drift problems, too, though they are less often reported or observed. The value of aerial application to agriculture in many parts of the country was stated, but several violations of good judgment were also noted. These included spraying over bodies of water; during periods of excessive wind; without regard to adjacent crops or properties, etc. Considerable technology exists to help reduce contamination, e.g., foaming agents, precision nozzles and equipment, etc. Some chemicals are likely more adaptable to aerial application without adverse effects than others. Assigning liability to applicator for contamination problems may reduce error in judgment.

Deleterious effects of spraying involve psychological as well as physiological phenomenan. Following a series of reported livestock and human illnesses that always occurred after aerial application in one location, applications using water only were made to examine effects on the number of such reports that would occur. The same number of illnesses were reported, thus verifying that emotions can play a substantial role in response to chemical application.

The general concept of integrated pest management to reduce overall pesticide use and the consequent employment of alternative pest control programs, e.g., rotation, plowing under debris, etc, in many instances will conflict with certain soil conserving (and nonpoint water pollution control) practices. For instance, no-till corn production requires an increase in herbicide use and increases the threat of disease and insect attack. Even with more precise application of farming technology, which is a requirement of such practices, it may be necessary to accept some compromise among ideal objectives.

It appears certain that control of nonpoint agricultural pollution while maintaining economic agriculture will require a high degree of management capability by the producer. It must also provide for flexibility of operation to cope with new situations, for example, new disease or insect outbreaks that arise. Consequently, educational approaches, supported by proper economic incentives, are considered to be a primary means of achieving agricultural nonpoint pollution control.

Summary:

Because of these factors identified, it appears that effective pesticide educational programs to minimize water contamination must be designed to deal with the commercial applicator and grower regarding their specific pest control techniques, including proper chemical selection, use and disposal; the general public must be educated sufficiently to alleviate emotional concern to the level that an objective "systems management" approach considering both economic and ecological factors can be employed in making necessary decisions; and an adequate educational program for urban pesticide users to reduce contamination from urban areas. When these are combined with adequate regulations to enforce necessary steps, our nation's water should be protected safely from pesticide pollution.

Workshop Session
Plant Nutrients

Discussion Leader: J. B. Jones

The 10 ppm NO_3-N concentration in waters as the critical concentration for determining water quality was discussed at great length. Waters in Israel containing up to 20 ppm NO_3-N are considered non-hazardous and acceptable. Similarly many waters in the United States contain NO_3-N levels at or above the 10 ppm level without noted health or environmental hazards. A closer look at the 10 ppm NO_3-N criteria for water deserves more study and possible adjustment upward.

A number of states (KA, CO, S.D., N.D., Minn.) in the north-central region of the United States offer farmers a soil test for NO_3-N. The sampling, analysis and interpretation vary from state to state but the concentration of NO_3-N found in a soil sample is used to adjust downward N fertilizer recommendations. This soil testing technique may have wide application. The test can be an effective educational tool to avoid N fertilizer excesses, and provides for the economical use of N fertilizers. The timing for collecting the soil sample is critical in high rainfall areas, not critical in low rainfall areas and of limited use in sandy soil areas. Arkansas is working on a soil testing and petiole analysis procedure to assist farmers in determing N needs for cotton production. The group strongly endorsed the use of soil tests as a measure of determining fertilizer needs.

A proposed national policy on the regulation of fertilizer nitrogen use was discussed. The group agreed that such a proposal would be very difficult to regulate. The program would have to tailor needs and recommendations to fit each state. Setting a maximum limit on N fertilizer rates would have the effect of encouraging low N user to apply the maximum allowable rate, thereby increasing the total use of N fertilizer. With today's increasing prices for N fertilizer, this may be an effective deterrent to excessive use.

It was agreed that Extension does have an important role to play in advising farmers on the potential environmental hazards associated with the improper use of N and other fertilizers. It was agreed that there is need for better data related to the economic consequences associated with fertilizer use if environmental restrictions are imposed.

Report and Highlights of the EPA/ECOP National Workshop on Agricultural Nonpoint Sources Water Pollution Control

September 16-17, 1974

Co-Chairmen: John R. Churchill and J. Benton Jones

The workshop was initiated by the Subcommittee on Environmental Quality of the Extension Committee on Organization and Policy. The purpose was to inform and involve State Extension personnel in environmental programs. Charles Ellington, Director of Georgia State Extension, in his introduction, made it very clear that Extension had an environmental education responsibility to the agricultural community, but that the Extension Service's first responsibility was to American farmers. The pledge was to assist in continuing in opening up communications between the Extension Service and EPA and the development of coordinated programs.

James Agee, Assistant Administrator for Water and Hazardous Materials, stated that EPA needed the full cooperation and participation of the agricultural community and the USDA agencies serving that community to develop the goals and means for an effective nonpoint source control program.

Francis Mayo, Regional Administrator, Region V, reported on the pilot projects being done under the Great Lakes 108 funds, with the major emphasis on how the agricultural community was involved in the project. Grant Merritt, State Director of the Minnesota Pollution Control Agency, discussed the evolving relationships of the State pollution control agencies in the agricultural community with particular attention to the permitting of feedlots under the solid waste law of Minnesota. Kenneth Mackenthun, Robert Thronson, and Paul Heitzenrater of EPA Washington staff, discussed the biological effects of agricultural activities, the status of our technical knowledge and research direction and our present EPA program progress.

State Extension personnel developed the following technical subjects and made several recommendations which will be included in a compendium of the meeting. The topics included 'Wind Erosion and Sedimentation' by Neil Woodruff of Kansas State Extension, 'Water Erosion and Sedimentation' by Minora Amemiya of Iowa State Extension and the 'Economic Implications for Wind and Water Erosion Control' by Harold Casper of the Economic Research Service in Nebraska. Frank

Humanik of North Carolina State Extension discussed 'Animal Wastes as a Source' and Robert Walker of the Illinois State Extension Service followed with a discourse on 'Plant Nutrients as a Source.'

The major issues brought out by the Extension people at the meeting were:

1. The Extension personnel did not clearly understand EPA's mandated goals or programs. Their major concern was "the requirement that nonpoint sources will be required to achieve no discharge by 1985."

2. Will enforcement of agricultural nonpoint sources thru water quality standards require a farmer to implement better than "Best Preventative Technology" recommended by State 303(e) guidelines?

3. EPA has lost credibility with the Extension Service. Many Extension Services were geared up to communicate the feedlot and irrigation return flow guidelines as requested by EPA. The delay in issuance of these and the substantial changes in the guidelines between their publication and promulgation got many Extension personnel out on the limb too early with the wrong message.

4. The Extension Service has very little communication with State pollution control agencies.

5. Most important, the Extension Service has a vast store of technology and projects EPA Regions are unaware of.

6. The recommendation of representatives of the Extension Service at this meeting is that the Extension Service take leadership in developing State-wide committees to write and issue State 304(e) guidelines.

7. It was made very clear by all that EPA should not ask Extension to actively participate in its regulatory responsibilities in order that Extension can maintain the confidence of the agriculture community.

8. Extension specialists were generally unaware of the 305(b) requirements and many recommended that Extension and other agricultural agencies be asked to cooperate in this first report.

Regional Coordinators/Extenstion Specialists

Summaries On

Nonpoint Source Problem Assessment

and

Recommendations For Future Joint Program Activity

REGION AND AREA

Region I - Boston, Mass
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

Reion II - New York, N. Y.
New Jersey, New York, Puerto Rico, Virgin Islands

Region III - Philadelphia, Pa.
Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia

Region IV - Atlanta, Georgia
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

Region V - Chicago, Illinois
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

Region VI - Dallas, Texas
Arkansas, Louisiana, New Mexico, Oklahoma, Texas

Region VII - Kansas City, Mo.
Iowa, Kansas, Missouri, Nebraska

Region VIII - Denver, Colo.
Colorado, Montana, North Dakota, Utah, Wyoming

Region IX - San Francisco, Calif
Arizona, California, Hawaii, Nevada, American Samoa, Guam, Trust Territories of Pacific Islands, Wake Island

Region X - Seattle, Wash.
Alaska, Idaho, Oregon, Washington

REGION I - Bart Hague

Identify Major Problems and Activities

A. **Massachusetts**

(1) Horse manure foremost, animal waste and dairy cattle next. (Intensive land usage Connecticut River Valley dairy farms poses problems re: any buffer strips).

(2) With very little regulation now, Extension has set up a Livestock Manure and Waste Management Committee (R. G. Light, Chairman). Comprises farmers, Commonwealth of Massachusetts Depts. of Agriculture Public Health, and Water Pollution Control. Thus, with Region I Permits involved, expect recommendations to be acceptable to regulatory agencies. The Committee's eight Task Forces embrace land applications farm processing plants, residue disposal, and financing implementation.

(3) Agricultural Economics Department has published bulletins on impact of poultry/dairy manure on land.

(4) County experts try to become "instant specialists" to help localities solve problems such as solid waste.

B. **Connecticut**

(1) Fear any guidelines would become law.

(2) Poultry greatest problem.

(3) Good coordination between USDA agencies and State Department of Environmental Protection (DEP). DEP staff attempting to visit every farm re: animal waste, in connection with State permit program (delegatee).

(4) USDA - State cost share farm waste management facilities (manure storage and diversive ditches. DEP issues permit on wide order; SCS

gives technical assistance; USDA (ASCE) helps fund.

D. Vermont

(1) Dairy wastes a problem on heavy clays.

(2) Statewide land use regulation promising, but must involve townships.

REGION II - Theresa Faber

Identify Major Problems and Activities

A. New Jersey

(1) The non-point source problems that the extension representatives felt were occurring were:

(a) Agricultural runoff into small farm ponds causing their eutrophication. At the present time the extension staff is controlling the resulting weeds by herbicides and dredging of the bottom by Mud Cats.

(b) Septic tank difficulties. There are problems in getting the Health Department to act toward enforcing the improvement of septic tanks.

(c) Small manufacturers, located along small streams, who are not discrete point sources.

(d) Leaching and seepage from junkyards and dumps into streams. There was some question as to whether or not this and the previous problem were actually point sources.

(e) Urban street runoff.

B. New York

(1) Non-point source problems in New York were felt to be:

   (a) The disposal, particularly on land, of animal wastes which come from the dairy and poultry farms, the predominant agriculture in the State.

   (b) Septic tank problems.

(2) The research activities undertaken in the State are:

   (a) Animal waste studies are being done to develop parameters for loading rates which vary with the time of the year.

   (b) A study is being performed to determine the effect of nitrogen fertilizers on the potato fields of Long Island. The area has difficulty in keeping levels of N below 10 ppm NO_3-N, so the research is trying to develop adoptable practices to minimize N concentrations and maintain yields, gearing practices to rainfall and crop needs.

   (c) An intensive sampling program is being performed on a watershed as a means to determine nitrogen and phosphorus levels. Input from the local STP can be readily determined, but it is difficult to separate septic tank and fertilizer contributions.

   (d) The dairy manure management committee has established guidelines that are available to the extension field staff.

II. Program Needs and Priorities

Northeast Needs and Priorities. A suggestion for study from New Jersey was the septic tank district concept where there would be a central authority as opposed to individual owners of septic systems. New York mentioned the agricultural district where rural non-farm uses would enter the zone at their own risk, i.e., be subject to agricultural odors. Further discussion mentioned urban development and land development concepts land use planning, and the variety of runoff problems for which controls are needed--deicing, highways, construction, and silviculture.

A major issue is whether extension should have the field capacity to cope with all aspects. Staff are self-training themselves to handle these problems.

III. Recommendations for Follow-Up

This was a joint discussion also, so our comments were written as a single statement. All agreed on the need for communication between Extension and EPA regional staffs. The group concluded that state-by-state meetings between key EPA programs and Extension, SCS, State agriculture and environmental agencies would open up needed lines of communication. Further relationships need to be developed between the county agents and program specialists as (land grant colleges as well as EPA and other environmental experts).

Ultimately, county and local personnel (such as county agents and RC&D supervisors) should be involved in local or subsequial workshops.

Subsequently, specialized problems (animal wastes, solid wastes, pesticide application) should be tackled through regional workshops. (i.e., New England divide).

Extension - SCS should be given the opportunity to provide major assistance to the States and EPA on 305(b) reports. EPA should alert Extension on pending requirements landowners would have to meet, such as post 1977 nonpoint effluent regulations.

Northeast Program Needs and Priorities. Hague attempted to seed some consensus on regional priorities as follows:

(1) Guide location, density, and siting design of development (especially second home) to prevent future pollution, especially septic seepage, sediment, and runoff in pristine resort areas.

(2) Develop pilot programs as individual disposal systems, including regional districts.

(3) Control urban runoff pollution, local design and ordinances for oils, deceiving materials, sediments, debris...

(4) Regulate road and building construction practices through constructive plan conditions and approval.

(5) Improve logging and sliding practices through forest practice legislative and technical assistance to the on-the-site working jobbers and operators.

(6) Provide specific information to land owners on effects of agricultural practices and animal wastes on specific lakes/streams and estuaries.

(7) Plan and regulate location and operation of landfills.

REGION III - Larry Merrill

The meeting among Region III representatives began with a summary of planning efforts relating to non-point sources that are underway in the Region. Besides the 303(e) basin planning efforts being developed in each State, the status of 208 planning was provided. Currently, the Region has four approved 208 designations and three others proposed. Also detailed was the State 305(b) reports and it was emphasized that all these efforts are a continuing process, with provisions and requirements for revisions and additions.

State Assessments:

Following the introductory talk, each State, with the exception of Delaware, provided an assessment of their particular problems in the areas of non-point sources relating to agriculture and what they felt was needed to improve efforts involved in non-point source control.

Maryland

Maryland representatives identified four areas of concern. These included: (1) sediment and erosion control, both in agricultural and silvicultural areas; (2) domestic wastes, involving sludge and septic tank problems; (3) land use policy relating to agriculture; and (4) pesticides-herbicides usage on the Eastern shore. What was felt to be most beneficial in combating the particular problems would be a greater degree of guidance and technical assistance from EPA, especially in the area of sedimentation. It was also felt that a clearer delineation of where regulatory power exists in present State and Federal agencies would enable a better understanding of what actions are being taken and what they are concerned with.

Virginia

Virginia expressed similar concerns as the areas of sediment control, animal wastes and pesticides are the major ones the State activity has been concentrated in. The problem of strip mine salvation has also received State interest. The State has done extensive work on sediment control relating to corn production; has developed State guidelines on erosion control; and worked on strip mine programs in the southwest area of the State. The delegates expressed the need for more of a coordinated effort between all agencies involved and would like to see a greater degree of State input into guidelines being developed by EPA on non-point source problems. As in Maryland, they felt an identification of all organizations involved in working on these problems and what they are responsible for would be beneficial.

West Virginia

Representatives from West Virginia detailed the State involvement in numerous non-point areas. These included animal wastes, strip mine revegetation, sedimentation, pesticides, solid waste runoff and the complex problems associated with flooding in the State. Among the State activities are preparation of a manual containing guidelines and standards on livestock wastes; programs on pesticide application in reference to the pesticide law; a soil erosion and sediment control handbook has been developed; and reclamation of strip mine lands.

Pennsylvania

Pennsylvania similarly has had a long involvement with non-point problems. Major areas of emphasis have been sewage sludge, mine drainage, and sediment control. In terms of sewage sludge, guidelines for on-lot disposal have been developed and investigations of the use of sludge on mine spoil tanks have been made. The need for more technical expertise in sediment control was voiced as the State sediment control law does not exclude agriculture as the ones in Maryland and Virginia. Work also has developed in pesticides as the State has a grant on developing a training course for pesticide applicators. The need for greater coordination with the State Department of Environmental Resources was expressed. The idea was forwarded to have an agricultural coordinator in the department and it was hoped that a lessening of the emphasis on point sources would be soon forthcoming.

Problems:

Recommended areas for immediate attention focused on the question of sediment control, the consensus major problem in the Region. The questions involving standards for sediment control, monitoring problems, definition of what excess sediment is and the issue of best practices versus effluent standards were areas that the State representatives felt needed immediate concern, other areas of regional concern for immediate needs included the problem of sludge disposal, possible air pollution effects on agriculture, and the question of land use policy.

Other problems identified were largely institutional and concerned the information coordination between the different agencies. Time-lag problems on getting information that is available to the people who need it were expressed. It was felt that a better system of distribution could be developed, especially on the Federal to State transfer lines.

Conclusion:

As a follow-up to the discussions that have ensued during the workshop, it is hoped that a series of meetings can be arranged between EPA and State Extension personnel to continue an exchange of present activities and develop and identify the areas where work is needed. It is felt that those meetings will continue the thrust of the workshop in reducing the coordination problems involved in non-point source work.

Through these meetings, EPA can draw upon the extensive experience that various State organizations have in dealing with non-point source problems and a continuing working relationship between EPA and the States can be developed to deal with agricultural non-point source pollution.

REGION IV - David Hill

I. Critical Evaluation of Institutional Coordination with EPA

The bigest problem the Agricultural Extension Service and State Unitersity people have with EPA is that, even when good communication is achieved at the regional and laboratory level, little results are seen and this communication often appears totally ineffective in determining what the agency finally adopts as policy. These agricultural personnel are very concerned that no matter what is said, the agency will come out with a unified, across-the-board set of guidelines to be universally applied. Feedlot guidelines are a case in point. The EPA published a document that did not address regional or State differences--and all this talk of cooperative efforts at arriving at non-point source guidelines appears to be following the same pattern -- will their input be ignored again this time? The EPA should set some basic standards and let the individual States determine the particulars for specific geographical areas within each State.

The results of workshops such as this, if seriously used by Headquarters personnel before final policy is determined, should go a long way in alleviating this particular complaint. There is still the opportunity with non-point source pollution control efforts to avoid rush programs, which often ignore input from others.

II. Agricultural Cost-Sharing Programs

There was a very strong concensus among all agricultural personnel present, and several EPA personnel, that agricultural cost-sharing dollars are some of the most effectively spent in the Government. The ACP, REAP, RECP Programs have proven extremely effective for involving the farmer in cost-sharing solutions to environmental problems. Farmers have frequently spent considerable sums of their own money to be able to take advantage of federal assistance. Joint EPA-Agriculture support for these programs might help to ensure that they receive higher administration support than they have over the past few years. However, these programs should not include a progressively larger percentage of cost-sharing from year to year (as the Construction Grants Programs have) or the farmer -- like the municipalities -- will choose to sit and wait while the federal ante rises.

III. Regional - State Coordination

The EPA Regions must coordinate with the State agricultural agencies and not just with the State pollution control agencies, to achieve significant agricultural pollution control. Joint meetings with all State agencies involved in a given program would certainly be far more useful than meetings only with the State pollution control agencies.

IV. Agricultural Non-Point Source Problems by Category

A. Water Erosion and Sedimentation

The greatest problems with water erosion and sedimentation come from construction sites: buildings as well as highways and rural roads. Cultivated fields are next in significance. Where grass or tree covers are maintained relatively little erosion problems result.

B. Erosion and Sedimentation

In the Southeast, large cultivated fields on the coastal plain are often subject to wind erosion and sedimentation.

C. Animal Waste

The need for proper handling and ultimate disposal of animal waste is in the following priority order: (1) poultry, (2) swine, (3) dairy and finally (4) bee as a low priority. Terminal disposal of animal wastes to the land in accordance with good fertilization practices should be approved as "Best Available Treatment Economically Achievable" (BATEA). A formal statement of this, by the Department of Agricultural and adopted by EPA as policy, would greatly help the Extension Service in convincing farmers to adopt this practice. Probably the most pertinent criteria for animal waste would be a COD-Nitrogen limitation on run-off, if a run-off requirement is necessary.

D. Plant Nutrients

Here, as with animal waste, the main problem appears to be nitrogen. Most streams in North Carolina, and to a large extent in the rest of the Southeast, are already sufficently high in phosphorus so that phosphorus is not the limiting factor in supporting aquatic weeds. The high price of nitrogen fertilizers may cut down on the tendency in some very intensive agricultural practices, to use larger amounts of nitrogen and than is necessary.

E. Pesticides

There was a fair mix of opinions on the significance of pesticides. Some of the evaluation appeared to be based on the operator's environment and the relative safety to the handlers or to humans accidently exposed to the treated areas. The increasing cotton acreage as the price of cotton increases has resulted in an increased use of toxaphene, which is a relatively hard pesticide. The use of herbicides has also been greatly increased, but the significance of these for the environment is probably less than for such insecticides as toxaphene.

V. Unique Problems Particular to Given Areas

The single largest agricultural environmental problem in North Carolina is likely to be created by the clearing and start-up of the 350,000 acre McLean farm in the outer coastal plain of North Carolina. Most of this area is in trees at the present time, but is being cleared for the production of corn and soy beans; and the rainsing of approximately 200,000 cattle per year, approximately 1 million or more hogs per year and possibly, also, a large poultry production. This is in Tyrrell, Hyde and Beaufort Counties located between the Albemarle and Pamlice Sounds. The land consists of low lying, poorly drained soil; generally the worst type for agricultural use.

The sandy soils of Florida, and perhaps to a slightly lesser extent-of the coastal plain in the other Southeastern States, often present severe leaching problems for fertilizers or animal wastes applied to the ground. Farming around Lake Okeechobee and Lake Apopka presents some of the worst problems for leaching of nutrients into the ground water. These problems are made worse by irrigation, which tends to wash the nutrients on through the soil.

VI. Extension Service Projects Relating to the Environment

A list of a variety of projects was submitted indicating that most Extension Service projects relate in one way or another to the environment. Effective screening of those lists could not be made.

REGION V - Carl Wilson

1. U.S. EPA organizational structure outlined

2. Legal authorization for U.S. EPA

(a) PL 92-500 Sections 106, 208, 303 and 305(b)
(b) Section 108

3. Region V called their first meeting with Extension Directors June 3, 1973

(a) Set in motion pesticide program

4. Subsequent meeting to be called in Region V by a letter to the Extension Directors. (Mayo to Extension Directors)

(a) First meeting latter part of October or early November, 1974.

(b) Meeting to be held in Chicago at our new location.

(c) Suggestion - Meet every 6 months.

5. State EPA's or Department of Natural Resources will be notified and asked to send a representative for the Nonpoint Source meeting in Chicago, October - November, 1974.

6. Topic of first meeting will be Nonpoint Source Pollution which will include 305(b) guidance.

7. Information needed

(a) Who will represent or be in charge of 305(b) reports in each State? Action - Letter to the States will request this information.

(b) Who in US-EPA will be in charge of 305(b) report coordination?

(c) States asked for who is in charge of nonpoint source program in Region V or 305(b).

Subject Matter to be Covered in Future Meetings

I. How can Extension participate with their present program?

1. Erosion - Sediment Control

   (a) Urban
   (b) Rural

2. Sludge and Wastewater Application to Land

   (a) Extension and EPA have called a meeting for the 10 midwestern States which will be a workshop on sludge and wastewater application to land.

3. Noise
4. Forestry
5. Strip Mining
6. Plant Nutrients
7. Septic tanks
8. Air pollution
9. Underground water pollution
10. Feedlots (animal waste)
11. Pesticides
12. Radio activity
13. Solid waste

Current Prrgrams on Nonpoint Source Pollution Region V by State

Indiana

1. Black Creek Project, Allen County Indiana, Maumee River Basin. (Implementation Project)

(a) 5 year program on 12,000 acre watershed US-EPA input $1.8 million to access the Environmental Impact of Land Use on Water Quality. Work Plan given to participants of workshop. This also include the Operations Manual. Section 108 funding.

Ohio

1. Maumee River Basin Study in Ohio, US-EPA input $370,000. Section 108 funding

Wisconsin

1. Menomonee River Basin Project, US-EPA input $2.2 million, Section 108 funding.

2. Menomonee R. Basin study $2.1 million IJC funding.

Minnesota-Wisconsin

1. Western Lake Superior Project (Nemadji River Basin) US-EPA input $2.7 million, Section 108 funding.

Michigan

1. Michigan Sub-basins studies, US-EPA input $953,000. IJC funding.

Discussion & General Comments

1. Illionis Proposed Plant Nutrient Regulation Hearings.

   (a) Region V Submitted a position paper.

2. Federal Register

   (a) Can a cross reverence be obtained by Sections of PL 92-500?

3. Minnesota presentation on feedlot permits and delegated authority to County Commissioners to carry out the law. But no application rate to land for guidance.

4. Feedlot and Nonpoint designs in general carried out by Soil Conservation Service! Design criteria should be reviewed by State and US-EPA for changes that are needed.

5. Comment by Carl Wilson. For fifty years or more Agricultural Scientist have been advocating increasing organic matter content of soils for soil stability and production. But when it comes to applying sludge to land the Agriculture Universities are silent. Why?

6. Comment by several participants on heavy metals in sludge.

(a) EPA (CDW) In the long run effluent discharge limitations may solve this problem. If it is a problem!

7. Forest soils could be a major place to apply sludge and wasterwater.

8. Strip mine land could be a place to apply sludge and wastewater. Approximately 12 million acres in the USA with 40, 000 acres in Illinois.

(a) Project in Illinois that treats effects of strip mine drainage instead of cause.

9. Nitrate problems

(a) Over 2 million dollars of private funds allotted to study this problem after Illinois Plant Nutrient Hearings.

(b) High NO in some well waters

(c) High cost of fertilizer may push farmers to a rotational system to obtain nitrogen. Example beans doubled cropped into wheat stubble.

10. Feedlot systems being sold by the private sector with no guidance. A critical problem.

11. Wisconsin - Are regulations really needed?

(a) Comment by CDW Ohio's approach seems to bee most acceptable. Such as:

(1) inspector will be hired to ask the farmer or rancher to make corrections. Soft sell by Soil and Water Conservation Districts.

(2) If no results are obtain by this methods Ohio EPA will do the enforcing.

12. Comment and generally agreed upon by the committee 305(b) reports that address themselves to nonpoint source pollution should be brought to public hearings for the land owners input. This would include farmers, ranchers and urban.

(a) US-EPA comment; the Water Bill 92-500 requires this approach to the problem.

13. Discussion on the Governor's Conferences on Erosion Sediment Control. Region V participated in 4. Ohio will inact a law by July 1, 1975. Mich. had one but retracted it for farmers.

REGION VI-Osborne Linquist

Task I - Identify Non-Point Source Activities of State Extension Services:

Extension representatives from four states in Region VI — New Mexico, Texas, Arkansas, and Louisiana -- reported similar types of activities on-going in non-point source pollution control. For example, Arkansas listed the following types of program areas:

1) Poultry litter disposal
2) Small cattle feedlot waste disposal systems
3) Soil and plant analysis to guide producers on manure application rates that will minimize pollution
4) Pesticide use and container disposal
5) Safe use of pesticides
6) Soil erosion control (in conjunction with Soil Conservation Service - USDA)
7) 4-H Land Judging contest
8) A new Extension Animal Waste Management Specialist.

Much the same work is apparently on-going in Texas, Louisiana, and New Mexico. Louisiana emphasized its work in dairy waste management systems and land disposal of effluent and manures. In Texas, a county agent workshop on non-point source pollution will be held this fall; a new Soil and Water Conservation Specialist has been hired; a multi-faceted program on land disposal of cattle feedlot manure has been on-going for 1½ years.

Task II - Identify Needed Joint Extension - EPA Activities and Means of Implementing These Activities:

1) The regional EPA non-point source coordinators should get in touch with directors of state water pollution control agencies to recommend that their staff contact appropriate Extension personnel for help in compiling the Section 305 and 206 reports.

2) In each state conduct a meeting of researchers, Extension personnel, state and EPA non-point source personnel to become acquainted and share information and ideas for technologies and regulatory strategies.

3) The State Extension Directors need to be made aware of the forthcoming non-point source programs so they can stimulate Extension activity on a multi-disciplinary front within their states. This could perhaps be accomplished through briefings by high-level EPA officials at the upcoming Extension Directors Southern Region Meeting or in committee at the National Association of Land Grant Colleges and Universities.

4) Exchange personel lists between state Extension services and EPA to foster direct contact between specialists and EPA officials most directly involved on a given question.

5) Consider holding multi-state Extension seminars for specialized interest or commodity groups to focus on regulatory mechanisms and technologies for abating specific types of non-point source pollution.

6) In an atmosphere of close cooperation between regional and state NPS staff, Extension specialists should establish timely, well-coordinated multi-faceted programs to educate, through county Extension staff, agricultural producers and associations as to the requirements for and methods of non-point source pollution control. Program needs and directions may vary tremendously from one state to the next.

7) Extension specialists should take the initiative to transmit pertinent research information, particulary that generated within their own states, to federal and state non-point sourcepersonnel to educate these regulatory officials.

Task III - Critical Evaluation of How EPA Can Be More Responsive:

1) Based on past experience with the EPA point source program, the NPS regional coordinators should be kept more closely informed by Washington - based personnel of pending developments and policies, however tentative they may be.

2) EPA should provide Extension specialists a long-range "roadmap" as to expected developments in regulating and controlling non-point source pollution. This is absolutely essential to (a) satisfy the sometimes rigid scheduling and programing contraints of State Extension Services, and (b) to preserve the credibility of Extension informational programs.

3) EPA should send out capsule summaries of pertinent deadlines for both point and non-point sources.

4) Anything affecting agricultural non-point sources should be passed from EPA Washington - based staff to interested Extension specialists as quickly as possible.

Task IV - Critical Evaluation of How Extension Service - USDA Can Be More Responsive:

1) Better communication between Extension Service - USDA staff and pertinent Extension specialists in the states should be achieved. The four-week lag time between issuance of ES administrative letters and their receipt by affected Extension specialists should be reduced.

2) The mailing list for the Extension Service's Environmental Quality News Notes need to be expanded if it is to effectively serve as the "house organ" in reporting environmental quality developments at the Washington level. By re-emphasis and re-thinking of its mission, this newsletter can provide the vital link between fragmented Extension educational programs in non-point source pollution control.

REGION VII - Don C. Drapper

Representatives from Extension present from Kansas, Missouri and Iowa. Nebraska absent except USDA, ERS person - complete list of attendees available.

Highlights of Discussion Items.

1) Any controls or recommended practices imposed on agriculture must be on an assured level for several years.

2) Controls hard to assess on lessee or tenant with only a year to year lease.

3) High priority for food production could result in constructive or destructive agricultural practices.

4) High "N" prices may well result in under fertilization resulting in higher erosion rates.

5) Iowa has only sediment control legislation in Region VII. They have established allowable soil loss values or "T" rates. The alternative is to establish a Best Preventive Technology approach and prescribe tillage practices, etc. Extension is not in favor of this idea.

Major Recommendations:

1) EPA should re-define policy on non-point pollution with respect to 77 - 83 - 85 goals, especially "zero discharge". Include some basic answers with regard to permits on farms and enforcement strategies.

2) EPA should clearly define short and long range strategy for nonpoint management.

3) Future program action in Region VII will provide for individual State meetings involving State Water Pollution people, USDA, University Extension, U. Research, State Agency and Conservation Agencies. Region VII will not attempt another meeting with the four State extension directors and the R.A.

4) Better coordination of research activities between EPA and all agricultural agencies is needed.

5) EPA should explore financial resources for funding agricultural research, demonstration, etc.

6) Technology is available to reduce soil erosion - How do we institute it?

REGION VIII - Bob Hagen

Erosion control and irrigation management programs are existing activities of Extension that can be utilized in Region VIII to addressing major regional problems. Significant impacts on the agricultural community, as well as on the rest of the regional environment are occurring from development of regional energy resources, principally oil shale ane coal. Such problems as transfer of agricultural water rights to industrial users and restoration of mined areas to support agricultural and other effects from mining on domestic and ranch wells, impacts of power plant emissions on plant and animal life, impacts on community services, and local institutions from increased population are among the major energy related concerns throughout most of Region VIII. There is a real need for Extension to provide advice on such matters as the rights of property owners and expected environmental impacts. This is an area in which Extension is beginning to respond, but additional program emphasis is in order.

Another area where Extension can be most helpful is providing advice to county and municipal governments on the impacts of recreational development. Throughout the mountain areas of Region VIII, tremendous changes are occurring in land uses as ski facilities, second homes (condominiums and cabins) and other recreational facilities are being developed at a rapid pace. Consultation on such technical matters as soils and water resources are necessary in order that county commissioners, city councils be properly informed of potential environmental impacts.

A third major area of need is to provide advice on urban water conservation. The major metropolitan areas of Region VIII are the Wasatch front in Utah (Salt Lake City - Provo areas) and the Frong Range in Colorado (from Fort Collins through Denver and Colorado Springs, to Pueblo). Both areas rely heavily on trans basin diversions from the Colorado River System and any savings in water use will benefit the salinity problems of the Colorado River. Minimization of water use will lessen impacts on the water use area as well, e.g. excessive irrigation of urban and suburban lawns not only saves water, but subsurface returns carry significant amounts of salts leached from the soils and surface returns carry fertilizers, pesticides, etc.

Institutional Problems:

It should be noted that in many cases, the technology is available to correct rural environmental problems. The need is for implementation, not technology development. Likewise the machinery presently exists for delivering the programs, e.g. REAP. Close coordination with USDA is essential in the provision of environmental services. It should be recognized that correction of some problems may create others, e.g. increasing irrigation efficiency could affect recharge and in turn affect shallow ground water supplies; automation of systems could create erosion problems. Institutional problems associated with coordination and provision of services appear to be significant, i.e. how can the Extension Service best serve the people in the State on environmental issues? South Dakota pointed out that their environmental specialist is supported by and works closely with the substate planning districts. This has been particularly successful in getting consideration of environmental issues in intergovernmental decision making. Other opportunities exist for getting involved in the planning process through the 208 and 303 planning programs. The importance of the 305(b) reports was emphasized. It was stressed that State interagency coordination is essential to the formulation of the 305(b) report and that this should be viewed as an opportunity to review existing programs as to the adequacy of the program and funding level to correct and prevent nonpoint problems.

EPA-Extension Service Accomplishments:

Entension/EPA coordination and communication was repeatedly emphasized as being very important. Region VIII has accomplished this by:

(1) Having State Directors in to meet the Regional Administrator and staff and to be briefed on EPA programs;

(2) EPA staff have gone to the States and explained EPA to the Extension staff;

(3) Region VIII/State agreements have been executed to formalize communication, coordination and transfer of information. EPA/Extension counterparts were identified as an attachment of the agreement.

(4) Region VIII/State Extension Service agreements for provision of services by Extension, i.e.

(a) assessment of nonpoint problems

(b) certification of pesticides applications

(c) develop and test educational programs (irrigation management).

Conclusion

Major areas for Extension involvement include the traditional agricultural functions, especially irrigation and erosion control and the merging areas of energy development, recreational facilities development and urban water conservation. Although it is not clear whether Extension has adequate authority to become involved in areas other than agricultural, it is clear that an expansion of activities cannot be carried out without additional funding. EPA should support Extension in requesting a greater role in matters on mutual concern. It should be clearly understood that Extension would be an educational arm, not a regulatory arm. Extension could lose their credibility with their clients if they are asked to aprticipate in regulatory activities, e.g. providing data on pollution sources, etc.

Region IX - Arthur Jenke, Hugh Burrows

The Region IX meeting had four representatives from California, one from Arizona, and none for Nevada or Hawaii. The meeting was led by Arthur Jenke of the Special Sources Control Branch as the regional nonpoint source coordinator was unable to attend.

State Assessment

The initial discussion centered on listing the activities that the Extension specialists were aware of in their States. Arizona currently has agricultural engineers designing and implementing facilities for confined feeding. The emphasis have been placed on dairy farms over the past two years. In one instance a city council passed legislation that led to the eviction of feedlot as a public nuisiance.

Arizona has an acute problem of topsoil erosion by both wind and water. State standards have been drafted, but were found to be inapplicable on Federal lands, highways, and Indian reservations. A major social problem to be solved here is that of the Indians' traditional feelings toward the land. There is an unwillingness, particularly amongst the Navahos, to fence their property in order to protect vegetation from cattle.

In the area of pesticides Arizona has several on-going programs. Mentioned were the Scouting Programs that educate the farmers on the use of pesticides when and only when necessary. These programs also involves a pesticide registration program along with certification of the user and written approval for the proposed application.

In the irrigation area, the Extension Service has been involved in the Wellton Mohawk Project, helping to maximize water efficacy on croplands.

California

In California, the Extension Service has been actively associated with the environmental issues for several years. Back in 1969, the Extension Service started holding Staff Training Conferences on environmental awareness. From these, the Committee on Resources and Environment was formed to deal with agricultural/environmental needs and concerns. This has led to a comprehensive educational program toward the agricultural community with the California Extension Service spending 67 man years on agricultural education last year.

There are on-going research programs in wind and water erosion in the delta area. The Extension Service has recently met with contract representatives of the EPA Region IX, pilot project in groundwater protection. The primary ground water pollution here is due to irrigation. In the animal waste area, the Extension Service has extensive information programs to the agricultural community. They feel education is superior to regulation. They supported this view with a recent survey that indicated that 99% of the dairies surveyed by the California Water Quality Control Board had implemented best practicable technology while only 90% were in compliance a year ago.

Initially, the California Resources Control Board ignored the entire field of agriculture in their Section 209 basin plans. Now, however, the Extension Service has developed a system of providing technical expertise to the basin planners.

In the pesticide area, the Extension Service has a series of monitoring programs in 24 study areas. Specific Extension programs have dealt with the effects of pesticides on endangered species, the drift problem, and minimum safe waiting periods between application of pesticides and planting of crops.

Problems and Needs

The Extension specialists from both Arizona and California agreed that there was a need for closer liaison between EPA and Extension. They also cited the need for faster and more decisive responses from the EPA regional office when requests are sent in for an interpretation or assessment of a law.

The discussion shifted to the ways in which EPA and the Extension Service could improve their working relationships. One suggestion was that EPA start coordinating their actions more through the State Environmental Agencies as this is the Extension Service's primary contact in dealing with environmental issues. The first step proposed was an invitation to the Directors of the State Environmental Agencies to meet with EPA Regional officials to delineate common goals and policies.

Following this representatives of the nonpoint sources program in Region IX should go to each State Environmental Agency to meet and discuss with their counterparts, the implementation of programs and policies for nonpoint source control.

REGION X - Gene Viers

The meeting with Extension Service representatives from the States of Region X was attended by Don Harter, and Roy Taylor from Idaho, Arlen Davison from Washington, and Ted Willrich from Oregon. Dr. Harter and Mr. Davidson were also attending the program planning meetings of the Extension Service as well as the nonpoint source workshop. Don Smith from Special Sources Control Branch sat in on the session.

Considerable time was spent in explaining the responsibility of the States in point and nonpoint programs, emphasizing the State responsibility and time frame for Section 305(b)E.

It was the Extension Service's view that there was a need for better communications and distribution of information.

Extension Service Activities:

The rundown on Extension service activities was somewhat limited. Idaho and Oregon were represented by the Agriculture Engineers. Principal programs are directed to animal wastes. (Other specialists such as agronomists or migation engineers would have had other activities to report.) It was reported that Idaho, Oregon, and Washington approach their problems and programs cooperatively in a Tri-State approach. The following are some reported ongoing activities:

(1) A Tri-State training meeting February 18-19, 1975 for county agents on waste management.

(2) A Tri-State meeting reporting the status of establishing application rates of manure to crop lands to be held February 26-27, 1975 at Pendleton, Oregon.

(3) EPA has a contract of $114,000 with Washington State University to produce training material for pesticide education.

(4) There are ongoing studies of how to dispose of pesticides containers and wastes.

(5) There is a seminar on Land Use and Energy September 24, 25, 26, 1974.

(6) A symposium will be held on "Animal Wastes Management in Rainfall Areas of more than 40 inches Precipitation".

(7) Idaho is assisting in development of education material explaining the irrigation return flow permits.

(8) There are ongoing studies of land disposal and utilization of sewage sludge.

(9) Studies of recycling and reuse of resources.

The Extension Service people pointed out the areas of their activities were in research, education and teaching.

General Discussion:

The extent of the agriculture nonpoint source compared to grazing or silviculture was discussed and the amount of lands under Fed. , State or private ownership was discussed. Overall, 83% of the lands in Region X are in Federal ownership. In the Tri-State area, Federal ownership is over 50%. This workshop apparently involved only agriculture. In our Region the Extension Service has silviculturists. (It is unknown whether EPA silvilculture project personnel have been in contact with the Extension).

Conclusion:

Present contacts and programs with the Extension Service in Region X has been on an "as needed" basis and it probably will continue that way. However, with a new Regional Administrator it may be advisable to meet with the Extension Service State Directors to have an opportunity to review or develop Region administrative procedures to facilitate operational cooperation.

List of Speakers

Charles Ellington Director of Cooperative Extension Service, Extension Building University of Georgia Athens, Georgia 30602	Introduction
James L. Agee Assistant Administrator for Water and Hazardous Materials (WH-556) Environmental Protection Agency 401 M Street, S.W. Washington, D. C. 20460	Keynote Address - The National Water Quality Strategy and the Role of Agriculture
Grant J. Merritt Executive Director Minnesota Pollution Control Agency 1935 W. County Road B2 Roseville, Minnesota 55113	Agricultural Water Pollution Control: State and Local Operations
Paul Heitzenrater Office of Research & Development (RD-680) Environmental Protection Agency 401 M Street, S.W. Washington, D. C. 20460	State of the Art in Identifying and Controlling Water Pollution from Agricultural Activities Research and Development
Francis T. Mayo Region V Administrator Environmental Protection Agency 1 North Wacker Drive Chicago, Illinois 60606	Agricultural Water Pollution Control: A Regional Perspective
Robert E. Thronson Office of Program Operations (WH-448) Environmental Protection Agency 401 M Street, S.W. Washington, D. C. 20460	State of the Art in Identifying and Controlling Water Pollution from Agricultural Activities. Water Program Operations
Kenneth M. Mackenthun Acting Director Technical Standards Division (WH-445) Environmental Protection Agency 401 M Street, S.W. Washington, D. C. 20460	Land Management Effects on Water Quality: An Ecological Perspective

Neil Woodruff USDA, ARS c/o Agronomy Department Waters Hall Kansas State University Manhatten, Kansas 66506	Wind Erosion and Sedimentation
Minora Amemiya Iowa State University 117 Agronomy Ames, Iowa 50010	Water Erosion and Sedimentation
Harold R. Casper **Dept. of Agriculture** **Economic Research Service** **Lincoln, Nebraska**	Economic Implications for Wind and Water Erosion Control
Frank Humanik Extension Biological & Agricultural Engineering Box 5906 North Carolina State Univ. Raleigh, North Carolina 27607	Animal Wastes as a Source
Ed Johnson Associate Deputy Assistant Administrator for Pesticide Programs (WH-570) Environmental Protection Agency 401 M Street, S.W. Washington, D. C. 20460	Pesticides as a Source
Robert Walker for Sam Aldrich Assistant Director College of Agriculture, AES 109 Mumford Hall Urbana, Illinois 61801	Plant Nutrients as a Source

WORKSHOP ON AGRICULTURAL NON-POINT SOURCE WATER POLLUTION CONTROL

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